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The Engineering and Mining Journal

Vol. 93. MARCH 16, 1912. No. 11.

The Situation in Spelter

During the last four months the spelter market has been in a peculiar condition. There has been an extraordinary and non-understood demand for the metal and a deficiency of supply. This has naturally produced a high level of price. The producers have, in the main, kept their books nearly filled for two to three months ahead, and buyers have been willing and eager to enter into such contracts. Belated buyers have had to pay fancy premiums to obtain prompt shipments, which have been obtainable only out of reserved supplies.

In referring to reserved supplies, it is not intended to imply the existence of stocks deliberately held back to corner the market, but rather to the smelters' safety reserves. Most smelters refrain from contracting the last pound of their expected production in any month, for the reason that some mishap may make them short and compel them to go into the market at the risk of having to pay a premium. In the course of time their safety reserves become released. Some smelters have also refrained from contracting everything in the expectation of realizing a premium later on. The quantity sold at the fancy prices is, however, relatively small, the bulk of the spelter being sold on contracts in the usual way.

It goes without saying that this condition, which has existed so long with alternating periods of amelioration and aggravation, is possible only in a market that is bare of stock. At the beginning of 1912, the statistics showed about 8000 tons on hand, but this included the spelter of other kinds than prime western, and the supplies in the hands of smelters who roll their own product, and of the remainder it was believed that substantially the whole was enumerated as stock simply because it was at the works, although in reality it had been sold and was awaiting shipment. There is probably no available stock in first hands today and we do not think there is any in speculative hands. Yet, as we have previously pointed out, it is incredible that actual consumption was going on at the rate of recent deliveries, and the only logical deduction was that consumers had been overbuying. This now seems to be generally recognized as the fact of the matter, certain of the large users having been persistent buyers and having taken more metal than there is any reason to believe to be their present rate of consumption. Accepting this premise, the reason for their action can be only their conviction that spelter is surely to continue to be a dear article, and is likely to go higher in price, either because of improvements in the galvanizing and brass business or because of shortage in spelter supply, or both. The suspicion has been expressed that the diminution of natural-gas supply is being more seriously felt at several smelting centers, with an adverse effect upon production. At certain places the reality of that situation is not disguised. This, of course, would be an adequate explanation of the recent course of the market. Whether the buyers will ultimately be correct in their diagnosis, or not, is, however, another matter.

Lake Milling Plans

The plan for the rearrangement of milling facilities at the Lake, announced by the Calumet & Hecla company, and outlined elsewhere in this issue, is a move that has been expected for some time, although perhaps not in all details, by those acquainted with conditions in that district. There can be little question that the frustration of the merger plans, so widely discussed a year ago, was a bitter disappointment to this great company, in its attempt to solve operating difficulties and to reduce mining and milling costs. The present plan to provide more ade-

quate and cheaper milling facilities, not by the construction of independent mills for each mine, but by increases in and a better utilization of the present equipment is a logical sequence to the ill starred merger. Its successful culmination should mean much that will be of advantage to the companies involved.

As was expected, transportation costs apparently played not a small part in the working out of this plan. Two interesting features of the announcement are: (1) The inclusion of Hancock in the plans, as this is an independent property, in no way connected with the Calumet & Hecla company or subsidiaries; and (2) the expressed intention of building a recrushing plant for the Tamarack. The plan, if carried into operation, will involve the permanent treatment of rock from several mines in one mill. The success of this may mean that in the future other independent mines may unite in building mills, doing away with the old idea that each mine in that district, must, if possible, have its own mill. The results will be watched with interest.

Camp Bird, Ltd., in Copper

It is interesting to note that the progressive Camp Bird, Ltd., continues to extend its operations, this time to a copper mine in the Transvaal. A circular has recently been issued to shareholders announcing an opportunity to participate in the issue of £250,000 six per cent. debenture stock of the Messina (Transvaal) Development Company, Ltd., the interest for five years on this issue being guaranteed by Camp Bird, Ltd. Three directors of Camp Bird have been interested in Messina for several years and evidently consider the developments in the Transvaal property sufficiently favorable to warrant their company's participation.

The Messina mine, which is in the Zoutpansberg district in northern Transvaal, is opened to a depth of over 800 ft. and the ore reserves in the last report of the consulting engineer were estimated at 430,000 tons above the eighth level, of which 102,000 tons were "blocked out," the remainder being designated as "probable ore."

Funds from the debenture stock issue are to be used in equipping the mine for a production of 120,000 tons per annum. The concentrating plant is to be enlarged and the building of a smelting plant is now to be undertaken in view of the agreement for the extension of the Government railway which is expected to reach the mine by the end of this year.

It seems a little odd at first to think of Camp Bird in connection with copper mining, but perhaps this is only another manifestation of the old saying that "it takes a gold mine to make a copper mine." The Camp Bird mine was an interesting venture that has already returned to its shareholders over £1,600,000, some of which has been reinvested in the Santa Gertrudis mine in Mexico, from which favorable developments are reported, and we hope that the company's copper venture will be a fortunate one.

The Coal Mining Unrest

The coal-mining labor situation in the United States is at a critical point. A settlement of the pending troubles seems to hinge largely upon the position in the anthracite region of Pennsylvania. The operators there have decided to reject all the demands made by the miners, and, as this is written, a committee is presenting this answer to the delegates of the union. This ends the first stage, but will not necessarily be the prelude to a strike, since it is quite possible that the miners may present modified demands which will have to be considered in their turn. Thus far the negotiations have been conducted in a manner which makes further negotiations not only possible, but probable, and it is still likely that a strike may be averted, though there may be a short stoppage of mining pending a final adjustment. The opinion of men well posted in the anthracite industry is that there will be no great difficulty in settling the wage question; the hitch will come over the demands for the check-off system of paying union dues and the closed shop. It is not at all likely that the operators will abandon the open-shop principle to which they have adhered for the past 10 years. The miners have this year a certain advantage in the fact that the great consumption of anthracite due to the severe winter has prevented the accumulation of reserve stocks, and a stoppage of production will be quickly followed by a shortage of coal.

The negotiations for a wage settlement in the Central West are at a standstill. The miners there are evidently waiting for the result of the anthracite discussion, and a strike in Pennsylvania will probably be followed or accompanied by another in the West, which will leave West Virginia and Kentucky to supply the demand for coal as best they can. Such strikes will certainly be followed by a serious derangement of industry everywhere.

The mining trouble is not confined to this country. Notwithstanding daily dispatches to the effect that a settlement is at hand, the general strike in Great Britain continues, and business is almost paralyzed for the time being. The intervention of Parliament seems to be near at hand. The German strike has assumed large proportions and is accompanied by much ill feeling, apparently. Serious rioting is reported, which has provoked military intervention at several points. Never before has the unrest in the coal industry been so widespread or so formidable in its probable consequences.

Senator Poindexter's proposed amendment to the Bureau of Mines Act sets the compensation for experts that the Bureau may have occasion to employ at $10 per day. We presume when the Bureau of Mines finds it necessary to employ one of the leading members of the mining profession, it will be compelled to resort to the devious ways used when Dr. Rusby was employed to assist in the pure-food investigation. It would be interesting to learn why the government must, in certain lines, be more impecunious than its citizens, and in other lines correspondingly more profligate.

The New York auction rooms are one of the graveyards of disappointed hopes. In their reports we read of such transactions as 232,031 shares of the London-Arizona Copper Co., $500 for the lot; 10,638 shares of Poland Mining Co., $7 for the lot; 46,379 shares of Lookout Copper Co., $100 for the lot. These were but a few of the sales of Wednesday a week ago. These were bubbles that exploded. What an anticlimax from the gorgeous promises of their promoters!

If the stock of copper at American refineries becomes utterly exhausted, as recently has been vigorously prophesied, it does not necessarily follow that we shall have a runaway market. In the absence of domestic supplies we might be able to import some copper from Europe.

Correspondence and Discussion

Views, Suggestions and Experiences of Readers

Amphidizer and Amphidization

In the JOURNAL of Feb. 24, 1912, p. 403, is mentioned my process for concentration of copper from its ores. In this article is the following statement:

> In A. L. Walker's paper on the "Metallurgy of Copper in 1911," on p. 47 of the Journal of Jan. 6, 1912, the terms amphidizer and amphidization are used. In the French pat. (No. 430,692) taken out by the Bradley company, an "amphigen" is defined, according to the Journ. Soc. Chem. Ind., Dec. 15, 1911, as "an element which combines with the metal to form either an acid or a base," and "amphide" is "a salt of which the acidic and basic portions each contain an "amphigen," and "amphidization" is the process of producing the amphide.
>
> It is difficult to see wherein the old terms oxygen, oxysalt, and oxidation do not meet these new demands.

This is a proper criticism and I am glad to have you bring the matter up. It was intended to introduce only the names amphidizer and amphidizing. Amphigen and amphide were only mentioned to explain the derivation of the name amphidizer and the act amphidizing.

I am quite content to fall into line on the conventional use of the terms oxygen, oxysalt and oxidation, but, in the selection of a name for the furnace, I was influenced by several considerations.

The formation of a sulphate from a sulphide deserves a specific name to distinguish it from other forms of roasting where the products of oxidation pass away as gases. The sulphur and metal remain in the solid condition and the oxygen is absorbed so that the sulphur, metal and oxygen enter into combination to form a solid substance at the working temperatures, and the sulphate of each metal forms at some minimum temperature and breaks up at some maximum temperature. These minimum and maximum temperatures occur with the different metallic sulphates with sufficient difference of temperature, so that, by maintaining a steady selected temperature, we can produce the salt of the desired metal, while the others either are not formed or are broken up; thus, by maintaining the amphidizer at 550° C., the iron and aluminum sulphates, if formed, are again broken up, and the copper, zinc and silver sulphates are formed and remain as such. Furthermore, it is not important with which metal the sulphur is combined at the start, for it will pass to those metallic sulphates which can exist at the selected temperature. Thus we have an apparatus capable of selective sulphating, a steady temperature being absolutely necessary.

The name first considered for this apparatus was "sulphater" or "sulphator." These names did not seem euphonious; then, it was my wish to have a distinct name that in time might become by use more specific and apply to a regenerative, selective sulphator.

The amphidizer, when fed with ore of constant composition, remains at constant temperature. With ore of 3% sulphur in the form of sulphides, no stoking is necessary, as the heat generated maintains the temperature; therefore, the attendance is almost nil, and a change of 10° C. in an hour is unusual. The ore leaves the amphidizer at about 120° C. higher temperature than it enters, so that anyone can calculate for himself the amount of heat units restored to the ore by regeneration of the ore, independent of the gaseous regeneration.

It is modestly hoped that the metallurgical fraternity will accept the name. It is not claimed that the amphidizing reactions are new, as the Ziervogel process with silver ores utilized the selective temperatures as early as 1841 and many workers have devoted much time to determining specific temperatures for each sulphate.

CHARLES S. BRADLEY.

New York, Feb. 28, 1912.

Where the Primer Should Go

In the JOURNAL of Mar. 2, in discussing where the primer should go, Clarence C. Semple states that "when using ordinary fuse there is but one place for the primer: the top or last cartridge to be inserted." That is generally the worst possible place for it, for the reason that, in firing a round of holes, one of the first holes to go is sure to knock the collars off several of the others, tearing out the caps and causing misfires.

In a drift round of 10 to 14 holes, average depth 5 ft., with a load of four to nine sticks of dynamite per hole, the cap should be inserted in the second cartridge placed in each hole. Then, if the cut holes knock the collars off some of the others, only the burnt portions of the fuses will be torn out, and the holes will still go in their proper order.

Similarly, in a stope round, with a charge of anything less than four sticks to the hole, the cap should be inserted in the first stick placed in each hole.

Loading in the above manner, I have repeatedly fired drift rounds of 10 to 14 holes, and got the full number of reports. In one instance I fired a round of 30 holes, average depth 3½ ft., average load three sticks of 40% powder, in a narrow stope where each pair of holes had to make room for those following; got 30 reports and found a clean break when I came back the next shift. Mr. Semple's fear of the dynamite catching fire from the fuse is unfounded. There are very few burnt holes nowadays.

His mention of the advantage of delayed-action electric caps is worth following up. They should do excellent work in drifting, but are not applicable to all phases of blasting in stopes.

HARVEY S. BROWN.

Victor, Colo., Mar. 7, 1912.

Absorption of Gold by Retorts

The reference made to the absorption of gold by cast-iron retorts in the JOURNAL of Mar. 9, 1912, recalls an observation I once made of a broken retort that had been in use for three years, and in which probably not more than 40,000 oz. of amalgam had been retorted.

The bottom of this retort had cracked off in a clean circle at a point about 2 in. above the bottom. The gold absorbed was enough to impart a distinct coloration to the inner layer of material, and this coloration was quite uniform to a depth of ⅛ in., but there were places where it extended downward almost to the outside of the cast-iron. No assays were made to determine how the gold was distributed, but it appeared to be a coating on the grains of iron.

AMALGAMATOR.

Baltimore, Md., Mar. 12, 1912.

Screening Ore Samples

In the JOURNAL of Mar. 2, 1912, an item under "Metallics," says: "An iron washer, or small weight, free to move on a laboratory screen, greatly hastens the screening operation." This will indeed hasten the screening operation, but in many cases it is an unwise proceeding. The washer or weight exerts a grinding action on the wires which wears out the screen unduly. It also displaces the wires and ruins the mesh. I have even heard of the washer being used in making screen analyses. In such a case it is absolutely fatal to accurate results.

FREDERIC P. DEWEY.

Washington, D. C., Mar. 4, 1912.

New Lake Milling Plans

The long-rumored plan for the rearrangement of milling facilities for certain of the Lake mines has been announced by the Calumet & Hecla company, simultaneously with the issuance of the annual reports for 1911 of the Isle Royale, Superior, Tamarack, Allouez and Centennial companies. Simultaneous publication is said to have been made in order that no stockholder of any of these companies should have advance information relative to the new arrangements planned.

The Plan

The sale of the Tamarack, 2-head mill is recommended, together with 30% of the stock of the company owning the pumping and lighting equipment of the Osceola and Tamarack mills. If this is approved, the opportunity of purchasing this equipment, millsite and stock for $230,000 will be offered to the Lake Milling, Smelting & Refining Co., the latter company being owned jointly by the Allouez and Centennial companies. It is further planned to remodel these two Tamarack heads, to erect from one to three additional heads and to remodel two or three of the old heads at the present Allouez-Centennial mill. It is stated that the present site of this mill, owned by the Lake Milling, Smelting & Refining Co., is well suited for the shipment of rock from the Superior, Isle Royale and Hancock mines.

The present stock of the Lake Milling company, 100,000 shares, all owned by Allouez and Centennial, will be increased to 250,000 shares and 108,000 will be sold from time to time to the above mines to provide funds for the purchase of a portion of the Tamarack millsite, as well as for the necessary remodeling and erection of new heads.

Transportation Costs

It is stated that the cost of transporting the Allouez and Centennial rock to the present mill is a large item, Allouez now paying 16c. per ton and Centennial 14c. It is expected under the proposed arrangement to reduce these to 12 and 9c., respectively. The plan reserves to these two companies a stock interest which assures the right to five stamps and involves no expense unless at some future time additional stamping capacity is required.

The Isle Royale will purchase a $140,000 stock interest in the Lake Milling company, assuring the use of two heads. This will make available in the spring one additional head for the Isle Royale company and a second one before the end of the year. It is stated that the cost of adding to Isle Royale's present mill would be more than the above and that further saving can be effected in construction and operating costs. These, with the profits from immediate increased production offset the added charge for transportation to the Lake Milling company's mill. Isle Royale's earnings for 1911 were more than sufficient to make this purchase. The Superior company will pay $240,000 for its stock in the Lake Milling company and the necessity for this company to construct a new mill is obviated. The whole scheme is stated to be a rearrangement of milling facilities which would seem to work to the advantage of all and to the disadvantage of none; that it involves a minimum cash expenditure and that it is difficult to see in what way any company is treated unfairly.

The announcement does not so state but it is evident from the foregoing, that the treatment in one mill of amygdaloid rock from more than one mine is less objectionable than formerly.

The Boston *News Bureau* summarizes the plan as follows:

(1) The sale of a portion of the Tamarack mill to the Lake Milling, Smelting & Refining Co., for $230,000.

(2) The purchase of 108,000 shares of the increased capital stock of the Lake Milling company (at present owned jointly by Allouez and Centennial) by Isle Royale, Superior and Hancock.

(3) Isle Royale secures additional mill capacity at small expense, although ore transportation costs will be somewhat higher.

(4) Superior is saved the necessity of constructing and financing its own independent mill.

(5) Allouez and Centennial secure adequate milling facilities and their ore transportation costs are materially reduced.

(6) Tamarack secures a purchaser for a portion of its mill, no longer demanded for its own use, and is provided with funds for the construction of a recrushing plant.

(7) No new financing by any of the five subsidiaries is involved and new cash requirements are comparatively insignificant.

Legislation Affecting Mining

Washington Correspondence

Representative French has offered the following bill (H R 18,657), which was referred to the committee on mines and mining:

That sections 2324 and 2325 of the Revised Statutes be amended so that the labor required to be performed or improvements made upon mining claims shall be regarded as coming within the provisions of the law when not to exceed one-half of the labor performed or improvements made shall be upon roads and highways leading to the mining centers in which said claims are located or to the particular claims in question from the public thoroughfare.

Senator Poindexter's bill to amend the Bureau of Mines Act was read twice and referred to the committee on mines and mining. Its provisions are practically the same as those in Representative Foster's bill, published in the Journal of Mar. 9, 1912, except it is definitely stated that the compensation for the services of an engineer or expert outside the Bureau of Mines shall not exceed $10 per day.

Guggenheim Exploration Co.

In a statement sent to the stockholders of the Guggenheim Exploration Co., dated Dec. 30, 1911, the assets and liabilities were shown as in Table I. Analysis of this statement shows a surplus of $23,474,178, an increase of $8,349,589 for the year. Of this increase $6,747,149 represents the net proceeds from the sale of American Smelters Securities Co. common stock. Table II shows the increase for the last three years in the surplus, total profits per share, and profits in excess of dividends.

TABLE I. FINANCIAL STATEMENT, 1911

Assets	
Treasury stock	$1,206,700
American Smelters Securities Co., "A," 154,000 shares	13,860,000
American Smelters Securities Co., 6% bonds, at par	1,500,000
*Esperanza, Ltd., 3016 shares	15,094
*Utah Copper Co., 404,504 shares	9,161,767
*Yukon Gold Co., 2,769,639 shares	9,883,088
*Alaska Yukon properties and equipment	1,170,230
*Miscellaneous investments	831,179
Furniture, fixtures and equipment	2,704
Bills and accounts collectible	121,483
Cash and demand loans	7,721,933
	$45,474,178
Liabilities	
Capital stock	$22,000,000
Surplus	23,474,178
	$45,474,178

*Carried at cost

TABLE II.—PROFITS

Year	1909	1910	1911
Surplus	$13,857,065	$15,124,589	$23,474,178
Profit	11.0%	16.1%	17.7%*
Dividends	2,074,840	2,079 330	2,079,330
Profit in excess of dividends	213,376	1,267,524	1,602,440*

*Exclusive of sale of American Smelters Securities common stock.

Since the actual value of the shares of the company is in excess of the book value, the directors have decided, in response to inquiries from a number of stockholders as to the present value of their shares, to publish the actual number of shares of the various securities held by the company, with the exception of the comparatively small item of miscellaneous investments, thus enabling stockholders to approximate for themselves the present value of their shares, based upon the market value of the company's holdings, but exclusive of good will.

The Canadian Mining Institute

The fourteenth annual meeting, held in Toronto, was highly successful; there was a large attendance and many valuable papers were read and discussed. The Cobalt and Porcupine districts were visited.

The fourteenth annual meeting of the Canadian Mining Institute was opened at Toronto, Mar. 6, by an address from Hon. W. H. Hearst, Minister of Lands, Forests and Mines of Ontario, who spoke at some length on the mineral industry of the province, its past history and prospects. A letter from the governor-general of the Dominion, regretting his inability to attend was read by the secretary.

President's Address

Dr. F. D. Adams then delivered his presidential address, in which he expressed great satisfaction at the extraordinary progress of the mining industry and the increasing part the institute was taking in its welfare. He had to announce a slight decrease in the mineral output of the Dominion, but that could be attributed entirely to the strike of coal miners in British Columbia. The provinces of Ontario and Quebec had shown a marked increase. As they had chosen him, a geologist, as their president, Dr. Adams said he thought he could not do better in his presidential address than show the aid the geologist had given in advancing the growth of economic mining. The president then proceeded to cite instances all over the continent where the predictions of the geologist had led to exploration and the production of vast mineral wealth. In the future, he thought, the information the geologist could give to the prospector in the north of Canada would be of even greater benefit than it had been in the West in past days.

An innovation proposed was a semi-annual meeting for the Western members of the institute, who might not be able to come as far East to the annual meet. He was also pleased to notice the growth in the branch movement. The institute had played a very important part in the framing of a code of mining laws for that part of Canada, where mineral lands were still under federal control. He was pleased to announce that the membership of the institute had grown from 850 to 945 during the year.

Several amendments to the bylaws were presented and discussed. The mineral statistics for 1911 were presented by J. McLeish, of the Department of Mines at Ottawa; T. Dennis, superintendent of mines for Quebec; Thomas W. Gibson, deputy minister of mines for Ontario, and E. Jacobs, for the Province of British Columbia.

At the afternoon session several papers were presented, including the "Ore and Coal Bearing Formation of the Yukon," by D. D. Cairns; "International Coal Competition," by Allen Greenwall; "Mining and Milling of Asbestos," by J. J. Penhale; "Anticlinal Theory of Petroleum Deposits," by Eugene Coste; "Manganese of New Ross, N. S.," by H. F. Kramm, and "Tungsten Deposits of Nova Scotia," by Victor G. Hills.

The evening session was devoted to accident prevention and safety in mines, a paper on that subject being presented by Dr. W. H. Tolman, of New York; Dr. C. H. Hair read a paper on the "Sanitary Condition of the Mining Camps," in which he urged the supervision of location and sanitation by the provincial boards of health. The discussion took a wide range and was joined in by many members.

Thursday's Session

The papers on Thursday morning included: "Concentration of Silver-Lead Ores," by S. S. Fowler; "Concentration of Silver Ores of the Cobalt District," by Prof. Robert H. Richards; "The Evans-Stansfield Electric Furnace," by J. W. Evans; "The Concentration of Iron Ores at Moose Mountain, Ontario," by F. A. Jordon; "Recent Improvements and Additions at the Canadian Copper Co.'s Works, Copper Cliff, Ont.," by David H. Browne; "Monel Metal," By Dr. William Campbell, New York; "The Hardinge Mill," by H. W. Hardinge, New York. There were brief discussions on several of these papers.

Geology and Mining

The papers read at the Thursday afternoon session included: "Some Characteristics of the Gold Bearing Veins of Nova Scotia," by E. Percy Brown; "The Domes of Nova Scotia," by T. A. Rickard; "The Origin of the Quartz Veins of the Porcupine District," by Dr. A. E. Barlow; "The Origin of the Porcupine Gold Deposits," by Reginald E. Hore; "The Newer Diabase in Preissac and Adjoining Townships of Quebec," by Dr. J. A. Bancroft; "The Coppermine Country," by J. B. Tyrrel; "Origin of the Ores of Cobalt," by Carl Reinhardt; "Cobalt, Its Past, Present and Future," by C. A. O'Connell.

Two or three of the geological papers called out sharp discussion, the tendency to depend on geology being sharply attacked by Prof. H. E. Haultain. In the evening there was a smoking concert, which was largely attended and much enjoyed.

The Friday Sessions

At the morning session, J. Parke Channing, of New York, read a paper on the "Miami Copper Mine," giving an interesting history of the development of that mine.

Other papers were: "The Decrease in Values of Ore Shoots with Depth," by F. L. Garrison; "Industrial Education for Miners," by F. H. Sexton; "A New Departure in Mining Education," by H. G. Carmichael. There was discussion on several of these papers, especially that of Mr. Garrison.

Workmen's Compensation

This subject was brought up and after some discussion the following resolutions were adopted with regard to the proposed compensation act:

"(1) That the workmen's compensation act be placed in the hands of a commission to be appointed by the Crown.

"(2) This commission shall collect a definite amount from each mining company, based upon the monthly payroll and proportionate to the risk incident to the business.

"(3) These amounts should be contributed by the employers and should not be collected directly or indirectly from the employees.

"(4) The distribution of this fund shall be in the exclusive control of the commission, from whose decision there should be no appeal to ordinary courts.

"(5) There shall be no liability except under the act, all common-law liability to be expressly excluded. We recommend the study of the Washington act, chapter 74, of 1911, and also the New Zealand act, with the Russian schedule of payments."

At the Friday afternoon session the following papers were submitted: "Use of Geology in Iron Ore Exploitation," by Dr. C. K. Leith. "Glaciation and Its Effect on Mineral Veins," by J. B. Tyrrel. "Additional Notes on the Formation of Contact Zones in Limestones," by Dr. J. F. Kemp. "The Classication of Sudbury Ore Deposits as Affected by Faulting," by Dr. A. P. Coleman. "Conservation as Affecting Mining," by James White. "Mining Laws," by Horace V. Winchell. "Company Law," by J. M. Clark.

In the last session of the meeting, on Friday, Mar. 8, papers were also read by W. R. Ingalls and Waldemar Lindgren. Numerous members participated in the discussion of the papers read at the various sessions.

Officers Elected

At the close of the session the secretaries reported that Dr. Alfred E. Barlow, of Montreal, had been elected president, having received a majority over his opponent, G. G. S. Lindsey, of Toronto. The other officers—chosen without opposition—were: Vice-presidents, Arthur A. Cole, Cobalt; R. H. Stewart, Trail, B. C.; Councillors, H. R. De Pencier, G. Herrick Duggan, Charles Fergie, W. S. Johnson, Montreal; J. J. Penhale, Sherbrooke, Que.; W. F. Ferrier, Toronto; R. W. Brigstocke, Cobalt; Charles E. Watson, Porcupine; Robert R. Hedley, Vancouver, B. C.; D. B. Dowling, Ottawa.

Arrangements for the Meeting

The arrangements for the meeting were in the charge of W. F. Ferrier, chairman of the local committee, and, as usual at meetings of the Canadian Mining Institute, everything was well arranged in advance, and all plans were carried out in a smooth and agreeable manner. The headquarters of the meeting and all of the sessions were at the King Edward Hotel.

Among the social features were a reception at the mansion of the lieutenant-governor of Ontario, and a "smoker" at the King Edward Hotel. The leading feature of the latter was a quasi-lecture by Prof. J. F. Kemp, describing "how he discovered the North Pole." This story, which was illustrated by lantern slides, was delivered with the wealth of imagination and dry humor for which Prof. Kemp is famous. On Friday afternoon, Mrs. J. B. Tyrrel received the members at her home, and in the evening there was the annual banquet of the institute, this being at the King Edward Hotel.

The Cobalt-Porcupine Excursion

After the meeting, a party of members and guests were taken to Cobalt and Porcupine under the auspices of the institute, and by the courtesy of the Ontario government, which provided railway transportation and accommodations. This party comprised Dr. A. E. Barlow, Dr. W. G. Miller, Dr. R. W. Brock, Col. A. N. Hay, Prof. F. H. Sexton, and Messrs. A. A. Cole, Theodore C. Denis, W. F. Ferrier, H. Mortimer Lamb, E. Jacobs, W. R. Ingalls, Henry Kehoe, Alex. Smith, B. Hughes, T. A. Rickard, Theodore F. Dwight, F. Lynwood Garrison, H. W. Hardinge and R. V. Norris.

Visits were made to the properties of the Hollinger and Dome companies at Porcupine, and to the Temiskaming, Crown Reserve and Coniagas, at Cobalt. The managers and staffs of all of these mines were hospitable in their entertainment and painstaking in their efforts to assist their guests in obtaining a clear understanding of natural and technical conditions existing at the several properties that were inspected.

Quincy Mining Co.

The Quincy Mining Co. finishes its 44th consecutive year as a dividend payer, and has paid dividends in all 48 years, with a total of $19,880,000. In the year ended Dec. 31, 1911, 32,550,440 lb. of "mineral" containing 22,252,943 lb. of copper was obtained from 1,382,524 tons of "rock," or 16.1 lb. of copper per ton of rock. This copper was sold for 12.725c. per lb. or $2,831,799, profits of $23,005 were derived from silver sales, and $17,859 from miscellaneous sources. Expenses were as follows: Mining expense, $1,786,460; opening mine expense, $223,178; taxes, $50,186; smelting, transportation, etc., $198,662; construction cost, $106,581; leaving $507,597 as profit.

Development is still well ahead of stoping, and the deepest openings in the mine show rock up to the average of recent years, giving rise to the belief the good copper ground will continue to the maximum working depth. The average depth on the dip of the lode is about 5200 ft. compared with 8600 ft. in the deep workings of the Lake Superior mines.

The most notable change in methods in the Quincy mines is the substitution of small light-weight drilling machines using high-pressure air for the heavy machines previously used. About 100 of the new machines have been installed. A new compressor takes air at 60 lb. from the old machine and compresses it to 100-lb. pressure.

It is stated that Dr. R. H. Richards has been studying the concentration problem exhaustively at the stamp mills during the last year and has shown that a better saving of copper can be made by more careful hydraulic classification. To this end, No. 3 classifier is being rebuilt, from which interesting results are expected. A new small jig has also been designed and built which develops great capacity for its small size; a classifier has also been designed and is being built.

Iron Works in the Transvaal

A consular report from Johannesburg says: "The formation of the Union Steel Corporation, of South Africa, Ltd., marks an interesting stage in the industrial progress of South Africa. It is proposed to establish iron and steel works and rolling mills at Vereeniging in the Transvaal, and the company is already assured of influential support. The government of the Union of South Africa has entered into an agreement with the company whereby the corporation acquires the preferential right to purchase iron and steel scrap from the government railways and shops for 16 years, at £1 per ton, for the whole of the Transvaal, and a large district south of it, and at satisfactory prices for the remainder of South Africa. The government has also agreed during the same period to increase the railway rates on exported scrap and to grant the corporation a reduced rate for transport of their scrap to the corporation's works, and also to place their orders for such iron and steel goods as the corporation produces with the corporation. The agreement provides that the company shall erect and install the necessary works for the business, and take delivery of the scrap within the times provided by the agreement. The company is also required after the third year of its beginning manufacture to make certain experiments in smelting, working and treatment of local iron ores. The government reserves the right to nominate one director on the board."

Determination of Sulphur in Sulphide Ores

By Stuart S. McNair*

A method which does not seem to be given wide enough mention in the textbooks, for the determination of sulphur in sulphide ores, such as heavy chalcocities and pyrites, is the following:

Fuse 1 gram of finely ground sample, well mixed and covered, with about eight grams of sodium peroxide in a nickel or silver crucible. Start the fusion at a low red heat and gradually increase the temperature of the fusion to the full flame of a bunsen burner. The fusion is completed when the surface is quiet, and the substance is decomposed. When cold, the fusion is leached with a weak solution of potassium chlorate to convert any sulphides, formed during fusion, to sulphates. Filter off the residues, and wash well with hot water. Discard the residues, acidulate the solution with HCl, dehydrate the silica, and proceed as in the ordinary determination for sulphur.

[The method is not widely given in English textbooks. It is referred to in Lunge's "Methods of Technical Analysis," Vol. I, p. 276. It scarcely seems necessary to oxidize with potassium chlorate after a sodium-peroxide fusion. If oxidation is necessary, the use of bromine would probably be preferable (cf. Furman's "Manual of Assaying"—Fahlbergle's method). The bromine should be tested for sulphur, and the solution should be boiled after acidulating to expel any excess. It would probably be necessary often to use a diluting medium, say sodium carbonate or chloride, to prevent explosions (cf. Fresenius "Quantitative Analysis," which recommends fusion with niter and an inert sodium salt). The method as given fails when barium is present in the ore, unless some sodium carbonate is used in the fusion.—Editor.]

*Stanford University, Calif.

Details of Practical Mining

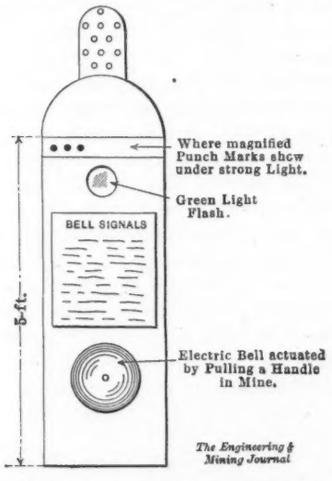
Accounts of Useful Ways of Doing Many Things in the Day's Work

This department is designed to treat in a brief way of details of everyday practice. Many readers are doing interesting things in mining and milling that other readers like to know about. The thought that there is nothing new in them should not be a deterrent to telling about them. Something that is an old story in one district may be quite unknown in another. Our draftsmen can develop any kind of a pencil sketch that is intelligible. A blueprint answers all the purposes of the engraver. Contributions are solicited.

An Electric Signal Device

BY P. B. MCDONALD*

Two German signal devices for hoisting, the general scheme of operation of which is shown in the accompanying illustration, have been installed in the Negaunee mine hoist house. When a man in the mine pulls the signal handle, two things happen in the engine room. The electric bell rings and a strip of paper resembling a stock exchange ticker tape is punched with a hole. By means of a strong magnifying device and mirrors, a magnified reflection of the small hole punched in the strip of paper appears in a horizontal aperture. Thus if the hoist engineer is not sure of the number of bells which were rung, a glance at the black circles tells him, also the strip of paper serves as a permanent record in case a dispute arises as to the signals that were given. In addition to these electric signal devices the old style mechanical bell will probably be installed, for use when the electrical apparatus is out of order. The green light flashes only when the paper strip of the punch-mark mechanism is exhausted.


Where magnified Punch Marks show under strong Light.
Green Light Flash.
BELL SIGNALS
5-ft.
Electric Bell actuated by Pulling a Handle in Mine.
The Engineering & Mining Journal

A GERMAN SIGNALING DEVICE

*Mining engineer, Negaunee, Mich.

Treatment of Copper Mine Water

At the Ashio copper mine of the Furukawa Mining Co., in Japan, the mine waters[1] are run over scrap iron, precipitating most of the copper as cement copper, and leaving iron sulphate with some copper sulphate in solution. This water is then used in the concentrators, after which it is run into a river which is used for irrigating rice fields. Consequently, it is necessary to clarify the water before it is discharged. The discharge amounts to about 600 to 700 cu.ft. per min., and averages about 0.00025% of copper. The water is run through three settling ponds, in the first of which slime and sand settle. In the second and third there is a slight precipitate of metallic hydrates, carrying some copper, and slime high in silica. The copper in this deposit runs from 0.5 to 1%. In the fourth pond milk of lime is then run in, in quantaties from 10 to 20% of the amount required for complete neutralization and precipitation of the sulphate in the water. This causes a precipitate to settle which is mostly hydrated iron oxide and free from copper, since there are five to six times as much iron in the solution as there is copper. The iron precipitate also carries down down with it most of the colloidal slime in suspension, consisting mostly af alumina and silica. The water is then run into a fifth pond, where the lime necessary for complete recipitation is added. This precipitates the metallic hydrates completely, the precipitate settling in this pond and in a sixth, from which it is run over a sand filter before it is discharged. The average of three analyses on the precipitate in the fifth and sixth ponds was as follows: Cu, 5.78%; Fe, 12.91; CaO, 6.76; Al_2O_3, 4.70; Mn, 4.40; SiO_2 11.25; loss on ignition, 30.90%: This precipitate is, as can be seen, rich enough to be smelted. The process saves about 18 tons of copper per month and gives a clear waste water which is not injurious to agriculture. The method is not patented.

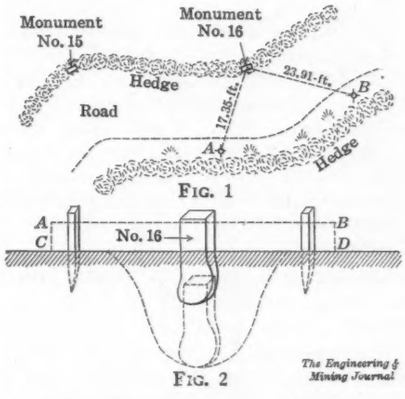
[1]Abstract of paper read at the New York meeting of the A. I. M. E., February, 1912, by J. W. Richards, of Lehigh University.

Replacing Survey Monuments

BY JAMES A. SEAGER*

It not infrequently happens that the mine surveyor has to superintend the removing and the subsequent replacing of the boundary monuments of a mining claim or concession, and it is obvious that the replacement must be made so that the monuments are in precisely their former position. A practical method of insuring this may therefore be noted by means of an example.

On one occasion it was found necessary to take up some boundary monuments which were close to a hedge, and to bury them in their old positions, as it was found necessary to do away with the hedge and level the ground for the purpose of widening the road. The method adopted can be easily understood from Fig. 1 in the accompanying sketch. Considering the method adopted for boundary monument No. 16, a peg was driven into the grass by the roadside at *A* and another peg was similarly placed at *B*. The distances from these pegs to the monument were then carefully measured and noted. The other monuments were then dealt with in a similar manner. The contractor in charge of the work was then told to remove the monuments, putting them carefully to one



METHOD OF LINING IN SURVEY MONUMENTS

*67 Belmont Road, St. Andrews, Bristol, England.

side, level the hedge and sink the necessary pits, and then to let the surveyor know when the job was finished.

At the appointed time the surveyor proceeded to the spot with tapes and the necessary assistants. The tapes were then held on their respective pegs according to the measurements noted, and were stretched out to the full. The position of the monuments as standing in the pit ready to be covered up were duly verified and the work was certified to be correct. The method adopted by the contractor to get the stones into their right positions is interesting and was as follows. Long wooden pegs were driven on each side of the monument, but well clear of them so that all three should be in the same straight line. This was, of course, done before the monument was in any way moved. A plank *ABCD* (Fig. 2) was next placed in the position shown by the dotted line and the position of the pegs and monument was marked upon it. Then after this the monument was taken up and the pit excavated, the stone was placed in the bottom of the pit and it was then an easy matter by means of the pegs, the plank, and a plumb line to insure that all was correct, this being afterward verified by the surveyor's check described above.

Rust Proofing Iron or Steel

The Bradley process of rust-proofing iron and steel as described by Percy S. Brown in the *Metal Industry* consists in forming an unoxidizable coating on the surface of the metal. This is done by heating the iron or steel objects in a muffle furnace heated with coal or coke. After introduction of the objects into the furnace the doors are sealed with brick to exclude air. A jet of hydrogen, made by decomposing steam, is passed into the muffle to mingle with a stream of kerosine that is forced into the muffle under pressure. The iron or steel objects become coated with a carbon and iron compound which has a blue color when the objects are withdrawn from the furnace. When cool, a thin coating of linseed oil is applied which changes the color to deep black.

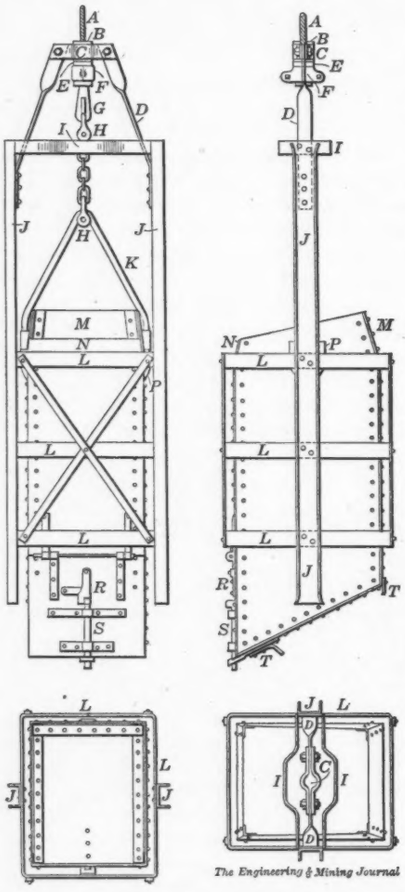
In appearance the coating much resembles that produced by the Bower-Barff process. The thickness of the coating or the depth of its penetration into the iron or steel depends upon the length of treatment in the furnace. The coating is very hard, having a hardness of about 9, and can be finished so as to have a high luster.

According to the report of the Department of Mines of Western Australia for the year 1910, there were 58 gas engines in use in mines developing 607 hp., while 2933 hp. was developed by 420 oil engines.

Skip for Cleaning a Choked Shaft*

CYRIL BRACKENBURY

The skip and rider frame shown in the accompanying illustration was designed for use in unwatering and cleaning out the Harvey shaft of the old Treasavean mine in Cornwall. It was desirable to use a small temporary compartment measuring 3 ft. by 3 ft. 2 in. in the clear and made by dividing the permanent ladder and pump-column compartment in two.



SINKING SKIP WITH RIDER FRAME

The two main hoisting compartments were occupied, at the time this skip was in use, by the electrically driven turbine pumps. The shaft was choked in several places and a skip was required which could be used in raising the old timbers, broken pump-rods, and pipes found in the choked shaft.

The skip and rider frame arrangement was specially designed to fit the peculiar conditions and requirements of the case and as it was found to answer most satisfactorily from the start, it facilitated the work, and effected a saving of time and labor. The channel iron *J*, which formed the chief portion of the rider frame, acted as guide and ran on 4x2-in. guide rods, fixed in the skipway. The rectangular iron frame *L* incased the skip or any other large and heavy body which was to be raised or lowered in the shaft. The top horizontal bars *I* were used to stiffen the frame and also as a safe step on which two men could stand to ride on the frame when it was traveling in the shaft; *C*, the top connection of the rider frame, when unbolted allowed the frame to be taken off the rope; it also encased the beechwood bushing *B* in the form of a reel, through which the wire rope passed; *D*, a rubber pad fitted into the cast-iron casing *F*, and formed with it a buffer between the rope socket and the rider frame. The iron casing *F* was made a comfortable fit for *G*, the rope socket.

The sinking-skip had a capacity of 24 cu.ft., and was made with a sloping bottom, so that the contents could be easily discharged after merely knocking up the door catch. The special feature about the skip was that it had no guides of its own, but was dependent upon the rider frame to carry it safely through the skipway, and as it was rectangular in shape, it could not revolve in the frame like an ordinary sinking bucket with crossheads. For the size of the shaft compartment it was possible to make it of much larger dimensions and capacity than an ordinary sinking bucket could be, and it was more easily discharged. The skip was made to pass easily in and out of the rider frame by the suitable shape of the bail *K* with the trunnion shield *P* and the sloping top *M* and *N*. The small rings *T* at the bottom of the skip were put there to pass a rope through in case it should be needed to help in guiding the skip into the frame, when moving up from the bottom of the shaft, but it was never found necessary to use a rope for this purpose.

This particular form of skip has the following advantages over an ordinary sinking bucket:—It has a larger capacity; it is more easily discharged; it will not revolve in the frame, and hence is safer and better for men to ride on, and not so injurious to the rope. The rider frame has the following advantages over the ordinary crosshead bucket-guide:—It is a safer guide in a confined space; it has sufficient weight to travel down the shaft on the end of the rope by itself; two men can quite safely ride on it alone; it is particularly suitable for drawing up large materials, such as pump rods, column pipes, etc., in a confined space. An ordinary skip would, of course, be most inconvenient and unsuitable for working continually below the guide rods and repaired portion of the shaft, as is the case with unwatering

*Excerpt from an article entitled "Unwatering Tresavean Mine," Bulletin 88, I. M. M.

operations, and, with a very small space left for temporary winding purposes, an ordinary bucket and crosshead guide would have been very inefficient and inadequate.

It can be easily understood how safely and conveniently other large and heavy material could be drawn up instead of the skip, providing it were possible to make one end enter the frame of the rider. By means of the rider frame and rope passing through it, it was possible to draw up the old pit work from the shaft quickly and conveniently. The combination skip and rider frame carried eight men, as follows, four inside the skip, one standing on top of the front end *N*, one on top of back end *M* and two facing each other on crossbar *I*. This number made a fairly close fit, but was quite safe for traveling in the skipway compartment of the shaft. A small bogie was used to remove the skip and rider frame from the skipway whenever the man cage was to be attached to the rope, which, however, was rarely done. The weight of the skip was about 650 and of the rider frame about 450 pounds.

Photographic Reproduction of Tracings

Engineers often find it necessary to make letter-size reproductions of tracings. A cheap and simple method of making a reproduction is given by G. W. Gilkison in *Engineering News* as follows:

The tracing should be gone over, making all lines and letters opaque. When ready, pick out a window (preferably one facing the north) that is larger than the tracing, so that no shadows will be cast on the edges, and in front of this stretch a sheet of tracing paper or cloth. Over this stretch the tracing to be reproduced, being careful to remove all wrinkles from both diffuser and drawing. If this is properly done the light should be evenly distributed and there should be no shadows.

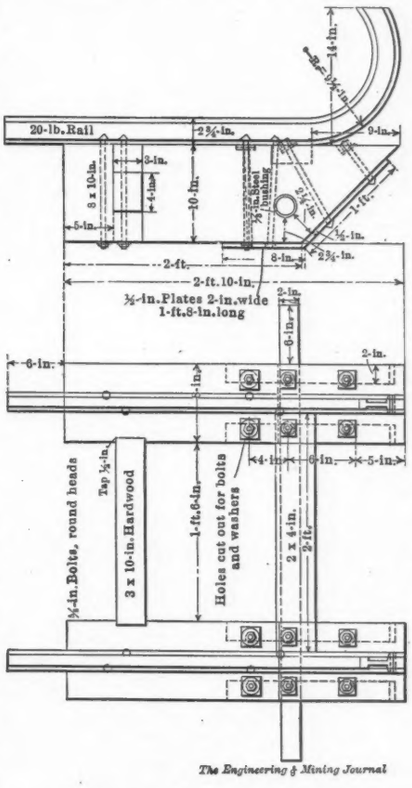
To obtain an idea of the exposure, hold an actinometer, face to the window, and note the time as per instructions. Make about four exposures on a plate by pulling the slide out different distances, using the smallest stop. When developed, if the correct exposure is not within the limits chosen, try again. After the correct exposure has been found, note the relation to the actinometer time. This relation will be a constant and can be applied to all actinometer times to find the exposure, provided the same plate and stop are used.

When a negative with contrast is desired, this may be obtained by using Cramer's contrast plates and Eastman's hydrochinone developer. Mix as directed, making the solution weaker if anything, as this tends to give contrast. With the above plate, develop until the image begins to show on the glass side, when, if properly exposed, the plate should be nearly opaque.

No special apparatus is necessary. A 10x12-in. box camera with a good lens and a few trays and bottles will do the work. It pays to get good negatives; this is all in the exposure. By using the smallest stop, good definition is obtained and the exposure is lengthened and can be more accurately timed.

Cradle for Dumping Mine Cars

At the Copper Range mines in Michigan the bodies of the mine cars are fastened tightly to the trucks so that cradles must be used to dump them at the shaft. In dumping on a level, as when filling a stope, the rails at the edge of the raise coming up from the stope below are bent down and then turned up into a hook to catch the wheels. In this way the body is allowed to drop enough so that the rock will slide out of the car.



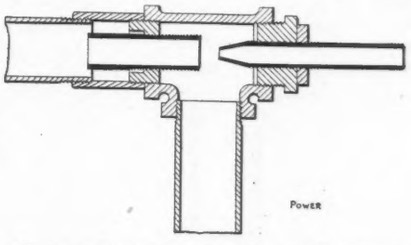
MINE-CAR DUMPING CRADLE

The details of the cradles which are made to template are shown in the accompanying drawing. Two strap-irons protect the front of the cradle timbers where they hit the floor of the station when the cars are being dumped. The axle on which the cradle turns is provided with collars to limit the side play of the cradle, while the axle is carried in strap bearings on two 6x6-in. timbers that extend back under the ties of the track so that they are securely anchored in place, and through them the cradle itself. Thimbles protect the cradle timbers from wear by the axle, and the rails on the cradle are turned up at the end so that the car cannot be pushed off into the shaft. In dumping, the front of the car either strikes the station floor or else the top of the skip if that happens to be raised a little too high, so that owing to its long body, the car cannot go over far enough to overbalance itself. Such would not be the case if the car had a short body like most mine cars used in the West.

In order to prevent accidents from men stepping on the cradles, the cradles, when installed, are always tested, even though made alike and according to template, and a cradle must be able to hold the weight of a man standing on the far edge without dumping. Otherwise a cradle might some time throw a man into the shaft when he happened to step on it. The car rests on the cradle in such a way that a little lift is necessary to dump it.

A Home Made Ejector

The accompanying sketch from *Power* illustrates the construction of a steam siphon or ejector that can be easily and cheaply made with a few common pipe fittings, and which may find application in some phases of the work about a mine. The suction pipe is 3 in. diameter while the outlet or discharge is reduced to 2½ in. The list of fittings needed is as follows: One 3-in. tee, one 3x1½-in. face bushing, one 3x1-in. bushing, one 3-in. pipe coupling, one 1-in. locknut (when a locknut is not at hand saw off a piece of a 1-in. coupling and use it as a locknut.) One 1½-in. nipple 6 in. long with the thread on one end long enough to permit it to be screwed through the face bushing to the center of the tee omitting the thread on other end, one 1-in. nipple drawn to a point with a ⅜-in. hole drilled into the small end.



SECTION SHOWING DESIGN OF EJECTOR

The 1-in. pointed nipple forms the steam nozzle and is screwed into the tee through the 3x1-in. bushing to within 1¾ in. from the 1½-in. nipple which forms the delivery nozzle. The 1-in. nipple has a long thread cut on the nozzle end to permit the adjustment of the nozzle as the siphon will not work unless it is prop-

erly adjusted. This can be done only by trying it, and when the nozzle is in the right place, the locknut is run up tight against the 3x1-in. bushing.

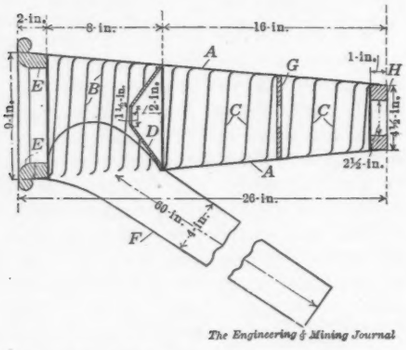
The nozzle works best when about 1¾ in. from the 1½-in. nipple, which forms the delivery nozzle. The 1½-in. nipple is screwed through the face bushing to the center of the tee.

About half the threaded part of the face bushing is screwed into the tee and the 3-in. pipe coupling is screwed on the other part. These siphons can be used for 12- or 15-ft. lifts throwing 2½-in. streams of water.

Another Dust Arrester

In discussing the schemes for allaying dust in the mines of the Rand before the South African Institution of Engineers, B. H. Lindhorst described the apparatus shown in the accompanying illustration.

The invention consists essentially of a conical canvas bag *A*, 26 in. long inclosing two separate conical springs *B* and *C*, 10 in. and 15 in. long respectively. These



A COLLAPSIBLE CANVAS DUST COLLECTOR

springs are contained in separate chambers formed by the conical partition *D*, made of hard rubber packing. *E* is a piece of felt one inch thick, four inches broad, forming a lining at the mouth of the bag and protruding two inches over the edge. This is attached to form a draft-tight joint between the edge of the apparatus and the working face. The diameter of the bag here is about nine inches. A canvas chute *F* over five feet long, leads away the dust to a bucket of water; *G* and *H* are circular wooden stays with holes in the center for allowing the drill to pass through. The other dimensions are given in the sketch. The spring *B* consists of eight rings and spring *C* of ten rings, thus making the former more powerful than the latter. The object of this will be seen later.

This device can only be used for the hammer type of machine drill. When the drill is about to commence work, the arrester is slipped over the steel and forced against the face. The air valve is then opened and the hole collared. If the hole is a water hole, the arrester is removed, and if a shoulder hole it is allowed to remain. As the hole deepens, the back chamber of the arrester closes up first, on account of the weaker spring, leaving the front chamber open for the free passage of the dust into the chute. As the hole advances further the forechamber also closes up gradually. When the starter has finished its work, the machine is turned back and the second bit inserted; the drill passing through the arrester. The same operation is again performed, until the hole is finished.

The rubber partition *D* is made conical so as to prevent the' dust from falling into the back chamber. The whole arrester when closed measures about three inches, that is to say, when it is used it takes away three inches of the depth of the hole. The total weight does not exceed 4 to 4½ lb., and the cost is slight.

Shifting a Bucket Dredge

It recently became necessary to shift the Stanthorpe Proprietary Dredging Co.'s bucket dredge about half a mile over dry land, says the *Australian Mining Standard*, Nov. 16, 1911. The work took about three months and a half. The buckets and tumblers were removed from the dredge for separate transport, but otherwise the barge was left intact. A rough track was prepared along the hillside for the dredge to travel on, it being run on hard-wood skids about 10x10 in. placed approximately two feet apart. Wire rope with suitable pulleys was fastened on the gantry framing of the dredge, taken out and passed around and connected to headers and thence back to the main hauling winch on the dredge.

Regular headers were not used at first, but the attempt was made to use trees and stumps instead, which usually pulled out as soon as the strain was put on them. The mistake was also made at first of attempting to use too light rope which constantly broke at critical moments. Later trenches were dug about 20 yd. apart and heavy headers put in. The weight of the dredge is 250 tons; the pull on the rope about 60 tons. At first, progress was slow, but toward the end of the journey an average advance of 60 ft. per day was maintained. Trouble was experienced throughout the period by the tendency of the skids to shift to one side when weight came upon them. The ground in some places also caused delay owing to its inability to stand the weight of the dredge.

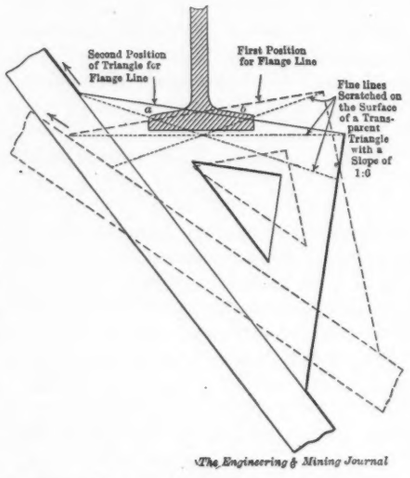
The total cost of the work was about £800 and the management claims that if it is necessary to remove the dredge again that the same method will be used. A suggested improvement is to lay a line of rails and mount the dredge on small wheels, as it is believed much work could be saved in the removing of the heavy skids.

A Suggestion for Draftsmen

By CARL HANSSEN*

For drawing bevels, where much structural designing is to be done, the line scribed on a transparent triangle, as shown in the accompanying sketch, is a great time saver. It is preferable to scribe two fine lines with a slope of 1:6, leading from opposite corners of any side of the triangle.

Placing one of the bevel lines parallel to the bottom of the flange and shifting the triangle to the height required, the first flange line of I-beams or channels may be drawn; by placing the second


Second Position of Triangle for Flange Line
First Position for Flange Line
Fine lines Scratched on the Surface of a Transparent Triangle with a Slope of 1:6
a
b
The Engineering & Mining Journal

SCRIBED TRIANGLES FOR DRAWING STEEL FLANGES

bevel line parallel to the flange and shifting to the desired height, the other flange line may be drawn.

This operation is much simpler than cutting the inner opening of the triangle to the desired slope, as was suggested in the JOURNAL of Dec. 9, 1911, and besides has the advantage of permitting sketching the flanges on a large scale.

To facilitate the lowering of timber, pipes, rails, tools, etc., required on any level in an inclined shaft, a movable landing stage may be employed. It is hinged to the edge of the plat over the shaft and is raised or lowered by pulleys. When in use the upper end engages with the rails of the skip-road, thus closing the shaft. This serves a double purpose, as it guards against material being carelessly dropped into the shaft, which is always dangerous.

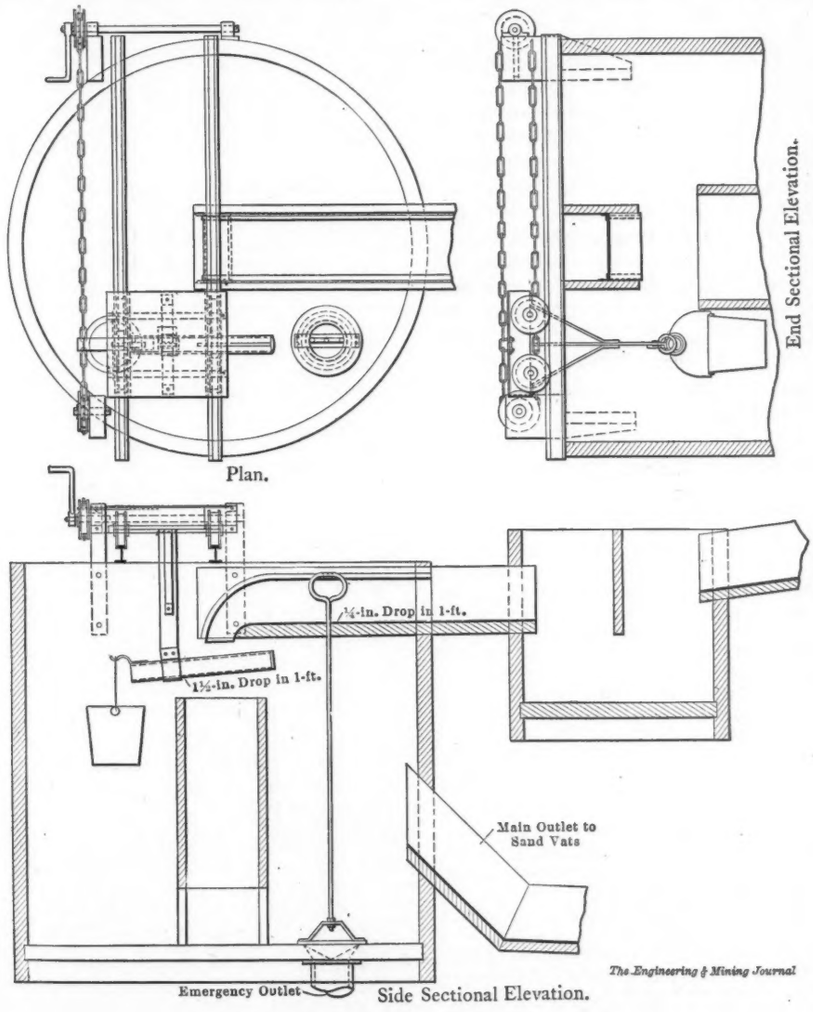
*Teziutlan, Puebla, Mex.

Details of Metallurgical Practice

Records of Experience in Ore Dressing, Cyaniding and Smelting

Sampler for Cyanide Plants

The sampler shown in the accompanying illustration was designed by W. H. Todd, and has been in use for a year at the Homestake sand cyanide plants in the Black Hills. In designing the sampler several new features were introduced to correct the more obvious faults of the usual sampling devices, and while the equipment is rather elaborate the results obtained have been most satisfactory.



HOMESTAKE SAND-SAMPLING DEVICE

The features of the design to which particular attention was given are: A small fore-sump, provided to receive pulp from several converging streams, and to cushion the velocity of these streams, thus insuring a smooth and steady discharge of pulp to the sampling sump; an iron deflecting plate at the discharge end of the short launder, connecting the fore-sump and the sampling sump, to direct the stream sharply downward as it delivers the pulp upon the slotted sampling pipe, preventing splash and possible contamination of the sample, for which further protection is provided by a short open conduit, placed vertically and immediately below the sampling blade. The discharged pulp is in this manner conveyed quietly to the bottom of the sump, whence it passes to the leaching vats.

The slotted sampling pipe is brought to a sharp cutting edge on its upper face, and is sufficiently inclined to insure clearance of all particles of the sample. It is supported from a carriage resting on overhead rails and is actuated by a chain driven by a winch, which in the sampler illustrated is actuated by hand, but which might as readily be attached to any convenient source of power. By this arrangement the sampler is caused to move across the stream at a uniform speed, and with the slot always at right angles to the falling stream.

Gold Absorption by Amalgamation Plates

The question of the absorption of gold by amalgamation plates has again been taken up by G. H. Stanley and M. P. Murray (*Journ.* Chem. Met. and Min. Soc. of So. Africa, Dec., 1911). The plate examined by the authors had been in use in one of the mills of the Crown mine for 12 years, and was about 0.14 in. thick. It had been sweated and scraped, but not sealed, before being discarded. The under surface was also amalgamated. A portion of the plate, on assaying, showed the presence of 1.69% gold and 1.31% mercury. Successive layers 0.02 in. thick were taken off by a planer, particular care being taken to free the edges by filing from any contamination due to the salting of the edge by amalgam working over. The seven portions ran as follows in gold: 10.48%; 0.0166; 0.00505; 0.0084; 0.0084; 0.0041; 0.0145; 0.0018%. The first layer contained 9.39 % of mercury; the last, the lower amalgamated surface, 1.89%. Mercury was also present in all other cases, but in amounts too small for determination.

This shows that over 99% of the total gold was contained in the first layer of 0.02 in. From microscopic examination it appears that the gold which existed on the interior of the plate, had not truly diffused into it, but that the mercury-gold amalgam had simply entered into minute blow-holes existing in the original plate. However, the amount apparently held by the interior of the plate amounted to only about 0.25 oz., while the total gold for the plate amounted to about 46 oz. On the basis of these experiments, true absorption is negligible, and the removal of the surface to a depth of 0.02 in. would give all the gold, which, from a mine point of view, would be worth recovering. This could be effected by the use of a large planing machine or by careful scaling or by several repetitions of sweating and scraping with hard scrapers with a fresh addition of mercury between each scraping. This latter method of cleaning recommends itself for use between short custom runs.

Colorado Mining Decisions

DENVER CORRESPONDENCE

Some important litigation was brought to a close recently when the U. S. Court of Appeals, sitting in St. Louis, Mo., affirmed the decision of Federal Judge R. E. Lewis in the apex case of the Doctor-Jack Pot Mining Co., of Cripple Creek, against the Work Mining & Milling Co., involving ore worth $2,245,000, alleged by the former to have been wrongfully converted by the latter. Judge Lewis entered judgment against the Work company and awarded title to the ores to the Doctor-Jack Pot company. Judge Lewis has also handed down a decision which throws out of court the Portland Gold Mining Co's suit against Stratton's Independence, Ltd., for the alleged wrongful taking of ores variously estimated as worth from $500,000 to $2,000,000.

The Supreme Court has handed down another important decision in the case of the Hart Consolidated Mining Co., which brought suit to restrain the assessor of Teller County from collecting taxes on the basis of the assessment made, alleging that he had violated the law in assessing the nonproducing 30 acres of the company at $540 per acre while the Morning Star, an adjoining producing mine, was assessed at only $125 per acre. Judge Gabbert, who wrote the opinion of the court, declares that the legislature has the right to define a producing mine as one having a certain output of ore annually. Although the limit of $5000 output, as fixed by the legislature, may be unjust to the mine owner who spends more than that amount annually in development, the court holds that it is difficult to frame any kind of assessment law which will not be unjust to some. The value of a mine, declares the court, depends on the output, and the value cannot be determined until the ore is mined. It is, therefore, stated to be just and constitutional to base the value of a non-producing property on the valuation of the lowest producer.

New Zealand 1910 Mineral Production

The report of the Dominion of New Zealand for 1910, recently issued, shows a total mineral production in that year of £3,774,898, a decline of £16,235 from 1909. Of this amount, the quartz gold mines contributed £1,564,189, while the total gold yield was 478,288 oz., valued at £1,896,328. The total coal output amounted to 2,197,362 tons, £1,219,737; kaurigum to 8693 tons, £465,044; silver, 1,711,235 oz., £171,562; and £22,227 is credited to miscellaneous minerals.

The Waihi Gold Mining Co. produced over one-half the yield from the quartz mines, viz., £894,815 worth, although for the first time this company showed a decrease in its bullion production, in spite of 25,207 tons more ore being treated. Alluvial mining suffered severely from prolonged drought in the South Island, the product falling off £157,210. The government decided to exploit the water powers of the country as state enterprises.

Rice and Scheftels Guilty

After their trial had dragged along for five months, George Graham Rice and B. H. Scheftels, of the Scheftels brokerage firm, pleaded guilty in the United States District Court in New York, on Mar. 7, to the indictments charging them with conspiracy and the use of the mails to defraud in seeking to create a market for certain stocks. Judge Ray sentenced Rice to serve a year in the Blackwell's Island penitentiary, the term to be counted as having begun on Dec. 29 last—the date on which Rice was locked up in the Tombs, after there had been a report of an attempt to tamper with a juryman in the case. Scheftels was freed under a suspended sentence. The indictments against the other defendants, Waterman, Belser and Stone, and against John Delaney, who had elected to be tried separately, were quashed.

In rendering his sentence, Judge Ray, addressing the defendants, said:

This prosecution was instituted under a statute recently amended, and this case is the first of the kind as to the nature and character of the scheme to defraud ever instituted or prosecuted under it. It has been an important case to the Government and to the people of the country as a whole, and to the Post Office Department, which undertakes also to prevent the prostitution of the great institutions of our Government.

The punishment of offenders is not the first consideration of counts in the administration of the criminal law. It is beyond the power of any man or court to measure the heart of a man with any accuracy; his motives or his weaknesses. The main purpose is to vindicate the law, give the public to understand there is a law and that its provisions cannot be violated with impunity, and also to give a warning to those liable to offend that punishment is certain.

In this case the main purpose of the law has been accomplished. Men will differ as to the wisdom of the course the court is about to pursue in the case of yourself, Mr. Rice, and of you, Mr. Scheftels. Many will think the sentence of the court is not adequate to the offense to which you have entered a plea of guilty, but the court takes the responsibility, remembering that "Vengeance is mine; I will repay, saith the Lord," and that the certainty and not the severity of the punishment is the most certain preventive of crime. Long terms of imprisonment are essential when the offender is a confirmed criminal and dangerous to society, a dangerous man to be at large. In your case I do not regard a long term of imprisonment essential to either the vindication of the law or to the protection of society. The law is vindicated and the prosecution by the Government fully justified.

The Court then sentenced Rice and, addressing Scheftels, said:

In your case, Mr. Scheftels, there is nothing that points to your having been engaged in any criminal matters heretofore, and I am glad of that. In consideration of that fact and of your years and the absence of proof that you have ever been guilty of any offense before, the court suspends sentence. I can only say, in all your business deals hereafter, Mr. Scheftels, be careful not to allow the love of gain to lead you into anything which may take from others their property, their money, their comfort. So long as you adhere to that you will go untouched by the arm of the law.

District Attorney Wise made this statement of the Government's view of the case:

The defendants, doing business as brokers, sought to create a market for certain stocks of which they held large blocks under option. These stocks they sought to sell to their customers at inflated market prices with a secret profit to themselves. In aid of their stock selling campaign they put out market "literature" cleverly devised to induce the public to accept their advice to order the purchase of the particular stocks in which they expected to make this secret profit.

These and other similar practices with which they were charged have been common in this city. Those engaged in such practices have not heretofore been prosecuted, and it has not hitherto been supposed to be practicable to prosecute them under the Federal statutes. This case has been regarded by the Government as a test case and one of far-reaching importance in that aspect. Its successful termination has established the criminal responsibility of brokers for practices which it had been commonly supposed would expose them at the most to civil liabilities. The prosecution, I am informed, has already had considerable effect in this community. The resulting conviction should have a still further effect.

Taking into consideration the expenditure of time and money that would be involved in the completion of a trial the end of which was not yet in sight, the hardship to the jurors in the case and the likelihood of some casualty that would result in a mistrial, the Government has felt that it would not be justified in opposing the plea of the principal offender. In my opinion, the interests of justice did not require the further prosecution of the other defendants who were minor offenders, and mere tools in the employ of Rice, and upon whom the lengthy trial had already operated as a serious punishment.

The operations of Rice and Scheftels in connection with the Ely Central Copper Co. were exposed by the JOURNAL on Nov. 6, 1909. Their concern was raided by the Department of Justice on Sept. 29, 1910.

A Chilean company has made an offer to the Bolivian government to construct a railway between Iquique and Oruro and other mining centers in Bolivia.

Progress in Mill Design

By Frank E. Shepard *

A review of milling practice with especial reference to the design and performance of the milling equipment. Some interesting data are also given respecting the capacities of various machines.

Note—A paper, reprinted practically in full, presented under the auspices of the Colorado Scientific Society and the Colorado School of Mines on Feb. 23, 1912, before the mining men of Telluride.

*President, Denver Engineering Works Co., Denver, Colo.

With the great variety of ores to be treated in the mining districts of this section, there have been developed many systems of ore treatment with the usual accompaniment of mechanical devices for the different stages of the process; consequently, we may be permitted to explore a wide range of subjects with particular reference to improvement in methods and machinery.

Hand Sorting of Ores

In the mill systems of Joplin, Mo., it is customary to crush the entire lot of mill ore, which in the sheet-ground districts is composed of about 95 per cent. of flint gangue and about 5 per cent. lead-zinc mineral. The flint gangue is hard, and in the crushing, great quantities of the galena and blende must be reduced to fines and slimes with consequent losses in the mill system.

Here would seem to be a most favorable opportunity to produce higher recoveries by means of hand sorting. If the original mine ore be sorted and one-half the gangue be thrown away to the dump, the sorted ore delivered to the mill bin would contain about 10 per cent. mineral instead of 5 per cent. in the mine run and the volume to be treated in the mill is reduced nearly one-half.

Much of the Colorado ore is finely disseminated and may not admit of hand sorting, but whenever possible this method of concentration should be carefully considered. Excellent designs of picking belts are furnished by a number of manufacturers and a well designed plant may be automatic as far as the conveying of the material from mine bins to the mill bin or dump is concerned. Coal companies find it profitable to hand pick the slate from the coal, and there should be equal opportunity with the ores of precious metals. The women and children of Mexico are well known as skillful ore sorters, and the patio of nearly every Mexican mine includes this branch of concentration.

Coarse Crushing

In large mills having capacities of thousands of tons in 24 hours the gyratory crusher appears to be in general use on account of the large receiving-hopper capacity, the automatic feed and the absence of vibration. For smaller mills the Blake jaw crusher is the universal practice from the simplicity of its mechanism and the few parts to be renewed. An interesting development of the gyratory principle is found in the Symons gyratory-crusher design and the practical rehalf the vertical height of the usual gyratory crusher design and the practical results are found to be satisfactory. Crusher-jaw plates of manganese, chrome and hardened steel are rapidly taking the place of the hard cast iron or even cast steel.

Under certain conditions the coarse-crushing plant may be situated at the mine. Electric power removes the obstacle of the high fuel cost at a remote station and the reduced size of ore may be an important factor in loading and conveying details. With the possibility of hand sorting of the ore and eliminating the waste rock at the mine, the capacity of the tram or conveying apparatus could be reduced.

Uniformity of Mill Ore

One of the most serious mistakes in the storage of mill ore is found in any plan which will not insure a uniform mixture of coarse and fine ore. In connection with the grizzly above the crusher for screening out the fine ore, there should be installed under the grizzly a chute so placed as to deliver the fines falling through the grizzly to a point under the discharge from the crusher so that coarse ore from the crusher shall be evenly mixed with the fines from the undersize of the grizzly. Then the day shift will have the same ore mixture as the night shift and the mill should run steadily with little change of adjustments.

If the fines falling through the grizzly fall directly to the back part of the ore bin and the coarser pieces from the crusher roll down to the front of the ore bin, then the day shift receives the coarse ore and the night shift receives the fine ore, which may need a general change of adjustments throughout the mill system. Given a steady, uniform feed and constant speed, mill adjustments may then be made with intelligence.

With problems of a large tonnage and with ores fluctuating in grade as well as physical characteristics, we may study with profit the ore-bedding system in large smelting plants. The handling of large quantities of ore by automatic belt conveyors and crane systems from suitably mixed beds of ore might result in improved mill recoveries sufficient to warrant the increased investment.

Automatic Sampling

The basis of all careful work of investigation is correct sampling, and sampling to be correct must be automatic. Messrs. Taylor and Brunton were pioneers in correct sampling methods, and in their plants a system is followed of taking a one-fifth cut, recrushing this one-fifth sample, then taking another one-fifth cut of the recrushed sample and so on—the whole sampling plant including five oscillating time samplers and crushing rolls between each sampler. In large milling systems a separate and automatic sampling plant on the lines indicated is well warranted, but in smaller mill systems the plan must be simpler. Two automatic samplers cutting a fifth sample with a mixing cylinder between the two samplers will give a sample one-twenty-fifth of the entire mill feed.

Two automatic samplers cutting a tenth sample, with a mixing cylinder between the two samplers will give a sample one-hundredth of the entire mill feed. In most mills this one-hundredth sample will bring the amount down to a convenient amount, which may then be further reduced by suitable laboratory methods for final assay.

Under some conditions this sample must be taken after the ore has passed the grizzly and crusher; then it may be necessary to install an extra elevator to give sufficient fall for subsequent mill operations. At the expense of additional installation it is certainly worth while to know the value of the ore with which we start operations.

In a roll-crushing plant a good position for the automatic sampling plant is just below the discharge spout of the elevator delivering the product from the coarse rolls, provided that no other than the original ore stream enters the coarse rolls.

It is even well to consider sampling the various ore feeds to the different mill units so that every phase of the mill system may be studied. Samplers have been designed to be controlled electrically from a master clock, so that the samples may be taken at regular intervals, or at times not anticipated by the mill operators. Such a system need not be too complicated, and with reasonable care will give most valuable records.

About 20 years ago J. H. Ernest Waters, of Telluride, Colo., became interested while in Denver in a steam-pressure recording gage, purchased one and had the gage installed in his office and connected with the steam mains of the boiler

plant without arousing the suspicions of the firemen. He took records for a few days and obtained some charts with the recorded steam-pressure lines looking similar to the trail leading to Bridal Veil Basin. Then he explained the recording gage to the firemen and showed them the records. Then followed records with a nearer approach to the circle. No doubt that pressure gage paid for itself many times in coal saved and a more uniform steam pressure. This to illustrate the value of accurate records.

Fine Crushing

Now we come to the parting of the ways with advocates asking us to take various paths. At this stage of the mill operations we find in Western mills three general systems of fine crushing: Rolls, stamp batteries and roller mills.

For the reduction of ore from crusher product, 1½- or 2-in. size down to a suitable size for coarse-jig or coarse-table concentration, the modern crushing roll employs the correct principles for the liberation of the mineral crystal with the least amount of slime product.

Modern crushing rolls are provided with adjustments so that the space between the shells may be changed while the rolls are in operation. Other details provide an end adjustment of the shafts to prevent beads forming on the edges of the shells. Forged-steel shells are the best for modern conditions. This material may be machine finished with special steel tools and the surface of the shells thus maintained a true surface for fine-crushing conditions.

Modern crushing rolls, with machine-finished forged-steel shells are used to reduce ores to a product as fine as 30 to 40 mesh, and if reasonable care be given the shells such fine crushing is possible. This means an even and regular feed across the entire face of the roll shell, and a new shell for the fine rolls whenever grooving or uneven wear appears, the worn shell of the fine roll being transferred to a coarser crushing roll. In large plants having shops, a lathe may be provided to resurface the worn shells.

The tendency, however, is to use crushing rolls for products not finer than about 12 mesh No. 19 wire (0.042 in.). This 12-mesh product is about the maximum for concentrating-table feed, and with the short tube mill already being established as an economical system for fine crushing, the range of roll crushing does not need to be outside the limits of, say 2-in. maximum down to $\frac{1}{24}$-in. minimum.

For the recrushing of jig middlings, rigid rolls have advantages over the spring rolls. The average size of the mineral crystal embedded in the middling particle determines the minimum size to which the particle shall be crushed. The rigid rolls may be set to the desired size and the middling particle is crushed down to this size and no further, the aim being to break the gangue portion away from the mineral crystal. The use of the rigid roll insures the maximum size of mineral crystal with the least production of slimes.

Survival of the Stamp

One of the great surprises in the development of mining machinery is the strong position occupied by the stamp mill. Here is a most complicated array of mechanism, producing a chaos of noise, requiring elaborate foundations and having a large number of renewable parts, and yet the ring of the stamp goes merrily on, followed by methods of amalgamation, lixiviation, concentration and cyaniding.

South African practice deals in terms of 2000-lb. stamps and the end is not yet. Such heavy stamp weights call for massive foundations and great increase in the dimensions of mechanical parts and yet the practice appears to be commercially successful.

The use of concrete in mortar blocks is a good advance in point of construction, maintenance and capacity. Cast steel for shoes, dies, cams, tappets and boss heads show increased service over the former cast-iron parts. The narrowing of the mortars at the issue level results in greatly increased capacities. The gradual change from inside to outside amalgamation reduces labor costs and loss through shutdowns. Separate-motor drives for battery units simplifies the plan from the complicated jack-shaft drives. Specifications now call for chrome-nickel steel as a material for the cam shafts.

Structural steel for the battery frame is quite possible. Probably the best form of battery post is a box column filled with concrete to reduce the sound and vibrations. Designs have already been made for concrete battery posts reinforced with steel rods all being molded integral with the concrete mortar blocks. Sub-bases weighing about 7000 lb. give sufficient bearing area for the mortars on concrete mortar blocks, instead of anvil blocks weighing 16,000 to 20,000 lb.

While the crushed product from a stamp mill shows a higher percentage of slimes as compared with roll-crushed products, some ores with a tough gangue material are most successfully crushed in the stamp mill.

Chilean Mills

The large mills treating the copper porphyry ores have brought about a rapid development in roller mills more familiarly known as high-speed chilean mills. In crushing tens of thousands tons of ore a day, certain merits must be found in this type of intermediate crushing device, but when one considers the renewal of large tires and die rings, screens, bearings, pinions and gears, the query appears, will this type of crushing mill endure in mills of great capacity?

Ball Mills

The cement industry has given us the tube mill, that fine-crushing device of great simplicity, and we shall yet appreciate the great value of the ball mill as a desirable intermediate-crushing device, possibly supplanting rolls, stamp mills and high-speed chilean mills.

The Krupp type of ball mill is successfully used as an intermediate crusher between the coarse-crushing mill and the tube mills, which grind to a final product of 100 to 200 mesh. The Krupp ball mill is cylindrical and is rotated on trunnion bearings, the feed being introduced to the inside of the cylinder at one of the trunnions.

On the inside of the cylindrical shell is arranged a series of steel shelves and perforated plates. On the outside of the cylindrical shell is a screen limiting the size of the crushed product. Inside the mill is a charge of forged-steel balls, the largest of which may weigh about 70 lb., varying down to the steel balls of about 2½ in. diameter.

Constructional Defects

With a suitable charge of ore delivered to the ball space, the rotation of the mill turns the mass of balls and ore over and over, and the falling of the balls from shelf to shelf crushes the ore to a size which will issue through the outside screen. While the product from this mill is excellent, objection is found to the shelves and perforated plates as well as outside screens to be renewed. If we may use the high crushing efficiency of the forged-steel balls and in some way eliminate the perforated plates and screens, we may have a very simple intermediate-crushing device.

Such a simple and compact crushing device seems possible. The scoop feed in connection with a spiral lining for the feed trunnion of the tube mill is a success. The device known as the tire discharge on the discharge end of a tube mill is a success. This tire discharge permits an opening about 20 in. in diameter, through which the fine-crushed pulp issues. In this 20-in. opening is fitted a reverse spiral so that any pebbles or large particles of ore falling into the grooves are carried back into the mill. Only the particles which have been crushed fine enough to be carried out by the current of water may issue as product. If, then, we design a ball mill, using the scoop feed for the feed end of the ball mill and use the tire discharge of 20-in. diameter opening for the discharge end of the ball mill we are utilizing two well known and successful elements. A reasonable proportion for the ball mill would be that the diameter be equal to the length of the shell. A mill 4 ft. in diam-

eter would be 4 ft. long; a mill 5 ft. diameter would be 5 ft. long.

The liners of the feed and discharge heads may be hard iron or cast steel. The lining for the cylindrical portion of shell should be of chrome steel or equivalent. The diameter of the balls should be between 3½ and 7 in. The larger the feed particle the larger the diameter of the balls.

Ore as coarse as 2 in. in diameter may be fed to the ball space of the mill by means of the scoop feed. The mill is to be driven by machine-cut pinion engaging with a machine-cut gear bolted to the feed or discharge head. When the mill is rotated the mass of balls and ore is carried up to about the level of the axis of the shell and the heavy balls rolling down the slope crush the ore. Fine-crushed ore issues through the 20-in. diameter tire discharge, any coarse particles or balls worn small being returned to the ball space by means of the reversed spiral inside the tire discharge.

Capacity of Ball Mills

The average results from several types of ball mills show that one ton of steel balls will crush about 50 tons of ore during 24 hr. from a feed of 1½-in. diameter down to a product of from 12 to 20 mesh in one operation. Using the same factor, Table I gives the sizes, capacity and power for such ball mills.

TABLE I. SIZE AND CAPACITY OF BALL MILLS

Diameter, Ft.	Length, Ft.	Wt. of Balls in Mill, Lb.	Wt. of Ore in Mill, Lb.	R.p.m.	Hp.	Capacity per 24 Hr., Tons
3	3	1035	207	35	7	25
4	4	3360	672	28	25	80
5	5	7650	1530	26	56	190

To compare this proposed ball mill with other types of intermediate crushers, Table II is given, assuming ore to be crushed from a 1½-in. feed down to a product passing 12 mesh, No. 19 wire, or about 1 mm.

This type of ball mill in connection with crusher and tube mill, making only three crushing units, will reduce ores from run-of-mine to slime pulps of 150 to 200 mesh, a simple crushing system for cyanide mills.

The ball mill makes suitable product for table feed and then the tube mill may recrush the table tailings or middlings. The consumption of steel balls amounts to about one pound per ton of ore crushed when crushing dry and two pounds per ton of ore crushed when crushing wet.

A review by S. F. Shaw of 19 cyanide mills in the United States and Mexico gives the following conclusion: "Jaw breakers are more favored than gyratory crushers; Dodge breakers are used in only one mill; stamps are almost universal for fine crushing; Bryan, Huntington and chilean mills are used in a few plants as intermediate grinders following the stamps. Tube mills are being used more and more for fine grinding."

By the use of a ball mill following a Blake crusher, run-of-mine ore may be reduced to jig or table pulps in two crushing operations without any screens in the mill system. The small number of mechanical parts; the small mill space occupied; the great range of products which may be produced with simple adjustments; the absence of screens; the crushing of dry ores as well as wet ores and the high capacity per unit weight of wearing parts are strong factors for the use of the ball mill in the intermediate crushing operations of our Western mills.

TABLE II. INTERMEDIATE CRUSHERS

	Capacity per 24 Hr., Tons	Hp.	Wt. of Crushing Moving Parts, Lb.	Total Wt., Lb.	Price
Chilean mill, 6-ft. diam.	40–50	25	20,000	50,000	$3600
Stamp mill, ten 850-lb.	40–50	20	8,500	35,000	2100
Ball mill, 4x4 ft.	70–80	25	3,500	20,000	1600

In designs for cyanide mills, the diameter of the ball mill and the tube mill might be the same, so that the feed- and discharge-head castings could be interchangeable between ball and tube mill.

The shell lining is bolted to the shell and the large tire-discharge opening permits the changing of lining without removing any manholes.

The Grondal system for the concentration of iron ores uses a ball mill along these general lines but the feed device is more complicated and the discharge is through a trunion bearing. The proposed tire discharge allows a larger and freer discharge as well as a convenient means for renewing the steel liners.

The Hardinge conical mill is a good type for ball-mill crushing and has been successful in several installations for intermediate crushing. The Blake crusher and Hardinge conical ball mill followed by the long cylindrical tube mill makes a good combination for cyanide mills in crushing to 150 or 200 mesh.

Coarse Concenration by Jigs

Concentration of ores by jigs includes sizes of feed as coarse as 2½ in. in diameter and down to sizes as fine as about 12 mesh, No. 19 wire, or about 1-mm. diameter. Formerly finer pulps were concentrated on jigs but since the advent of the reciprocating table ore pulps finer than 1 mm. are treated on the tables.

The Butte copper ores are jigged as coarse as about 2½-in. diameter and the rich pieces of ore including chalcopyrite, chalcocite, enargite and bornite are subjected to a heavy jigging action with the result of excessive attrition and liberation of a considerable proportion of slimes which cause difficulty in subsequent mill operations. Such coarse jigging of friable ores might be replaced by improved systems of picking belts and thus prevent the loss through formation of slimes by attrition. The power and water consumed in such heavy jigging operations are large and the machinery needs to be heavy. When the jig feed is smaller than 1-in. diameter the power and amount of water are greatly reduced. The average sizes of jig feed in American practice probably lie between 1-in. and $^1/_{32}$-in. particles.

Without doubt the jigging of ores is one of the most interesting and the most complicated of milling problems, combining as it does the study of the crystalization of minerals, specific gravity, cleavage planes, relative hardness of mineral and gangue, distribution of mineral contents in the gangue matter, association of minerals of nearly equal specific gravities, and endless combinations which often present baffling problems. Added to these questions are the various jig adjustments referring to stroke, speed, depth of bed, number of jig compartments, relation of screen aperture to feed particle, and combinations varying with each variety of ore, all requiring careful and persistent study.

Jig Capacities

The familiar type of Harz jig found in our western mills consists of one to four compartments, or more, each compartment being 18 to 20 in. wide and 24 to 40 in. long. This Harz jig, under average conditions will treat about 1½ tons of feed per square foot of jig-screen area per day of 24 hours.

The large jigs of the Joplin district are often found with 7 compartments or cells, the area of each compartment being about 20 sq.ft., or a total of 140 sq.ft. of jig-screen area. These 7-compartment Joplin jigs treat at the rate of 700 tons per day of 24 hr., or 5 tons of feed per square foot of screen area.

The Hancock jig, the feature of which is the movable screen, is a successful type for large capacities and will treat about 10 to 15 tons of feed per square foot of jig-screen area daily.

All these jigs employ both a pulsion and suction cycle of water current through the jig screen. The average water consumption for Harz jigs in American practice is about 4700 gal. of water for every ton of ore treated.

The Hancock jig uses from 350 to 800 gal. of water per ton of ore treated, a very low water consumption.

Richards Pulsator Jig

A few years ago a series of tests on the pulsator jig showed in practical mill operations that one square foot of screen area will treat 100 to 180 tons of ore in 24 hours as compared with 1½ tons for the Harz jig; 5 tons for the Joplin jig; and 10 to 15 tons for the Hancock jig. This high rate of the Richards pulsator jig is made possible by the use of a pulsion stroke only. In the earlier designs the ore bed was 10 to 14 in. deep, requiring about 30-ft. head of hydraulic water at the rate of 1000 to 1200 gal. per ton of ore treated.

The later designs make use of an ore bed but 4 or 5 in. deep and a consequent reduction of the head of hydraulic water to 10 or 15 ft. This reduction of hydraulic-water head has reduced the amount of water to 600 or 700 gal. per ton of ore treated, or about one-seventh the amount of water required in Harz jigs.

The latest types of Richards pulsator jigs also have separate pulsator valves for each compartment, thus giving accurate and wide ranges of adjustment to suit different conditions of ore treatment. Dewatering devices are also placed between the compartments to allow closer and more complete separation between minerals of slight differences in specific gravity. While the theory of this pulsator jig is based on a screen-sized feed, yet in practice a rather wide range of sizes is permitted.

The concentrates are particularly clean with a minimum of attrition from wear of concentrate particles in the jig bed.

The Richards jigs at the Lewis mine, Telluride, deliver concentrates ranging from 65 to 70% lead. In the Bonanza mill, Saguache County, lead concentrates are produced as high as 79% lead. In the Cobalt district, Canada, Richards jigs are making concentrates of the smaltite and niccolite ores running as high as 4000 oz. of silver to the ton. A jig installation in Sonora, Mexico, produced argentite concentrates running 400 to 500 oz. of silver per ton. Low-grade iron ores of 40 to 45 per cent. have been enriched to 65 per cent. iron.

There is no doubt about the favorable application of this pulsator principle to a wide range of ores. The number of necessary mechanical details of the Harz type of jig are replaced by an extremely simple rotating valve requiring a small amount of power and lasting through a long time of service. In several designs of Harz type, great attention has been given to mechanical elements which shall give a pronounced pulsion-water stroke *up* through the screen and to diminish as much as possible the suction stroke *down* through the screen. This differential motion, so called, is found to give a greatly increased capacity and also reduces the blinding of the jig screen.

A study of the elements of mechanism to produce such differential motions will show complication and the necessity for constant attention to adjustments and renewals for wear.

The simple mechanism of the Richards pulsator valve, consisting of but one moving part and entirely automatic action gives this pronounced pulsion stroke with no suction whatever. The recent design having separate pulsator valves for each jig compartment gives additional automatic features allowing any possible jig adjustment.

In the desire to have a simple mill system valuable features are often omitted which would produce higher recoveries. As our ores become more and more complicated we must expect some additional complication in our mill mechanisms as well as greater care and personal interest on the part of mill operators.

Jigging is a mill operation requiring previous preparation of grades of ores as well as in concentrator-table work. We can throw a mixed pulp on a concentrating table and obtain some result but we find that suitable classification into grades produces better quality as well as quantity of products.

The grading of jig feeds, the dewatering of pulps, regularity of feed, uniform water pressure, uniform speed of power —all these are of great importance and all need well developed details here and there in the mill system, and above and behind all there must be a big strong spirit of personal intelligence, interest and coöperation.

Pulp Classification for Tables

Progress has been made in the application of important principles in the classification of ore pulps previous to table work, but there is much more to study and to do before we reach the reasonable efficiency. Does it pay to consider all these additional devices designed to produce higher recoveries?

Assume a mill of 100 tons capacity during 24 hr., the crude ore runs $10 per ton; the mill makes a recovery of 70%. Suppose by the addition of some device an increased recovery of 75% is obtained. This means an additional wealth to the amount of $18,250 per year. In an ore carrying $5 per ton an increased recovery of 5% means an additional saving of $9125 per year.

The preparation of fine pulps previous to table concentration involves two general systems, one based on the screen sizing of pulps producing grains of nearly uniform diameter and the other known as the hydraulic classification of pulps, in which the mineral grains are small and the grains of gangue material are comparatively large, or the result of equal falling grains of mineral and gangue in a still body of water or an upward current of water. As mill systems increase in capacity the mechanical difficulties found in maintaining fine-screening systems become too great and so the tendency is toward the application of the hydraulic principles of classification.

To Dr. Robert H Richards is due the great credit for the many practical applications of hydraulic classification for if one will study the results of his 40 years of investigation it will be found that the most successful hydraulic classifiers in the mill systems of today utilize some feature developed by him. The hindered-settling design, as well as the Richards-Janney, are developments of the earlier design known as the vortex classifier.

The Richards pulsator classifier is successful in the classification of a wide range of ores. Recent designs have reduced the number of parts to adjust so that now only one water gate valve is required to be adjusted, whereas in former designs separate water valves for each of the six compartments were required to be adjusted. The gates between the compartments have also been removed and the adjustable concentrates-discharge gates have been removed and in their place are spouts which require but one preliminary adjustment.

Launder Type of Pulsator Classifier

The use of the screen in this type of classifier has resulted in the saving of high-grade shipping products direct from the classifier but under some conditions of water supply difficulties are found from the screen blinding and recently there has been developed a type of classifier utilizing the many favorable features of the pulsator-water current and doing away entirely with the use of the screen. This improved form is known as the launder type of pulsator classifier and this design permits the use of any number of pulp classifications to suit the requirements of the mill system.

An ordinary wood launder is used running above and near the feed end of the concentrating tables, separate sorting columns provided for each table, are bolted to the bottom of the wood launder with a separate pulsator valve for each sorting column so that each table may have its own particular adjustment. The only adjustment to make in this launder-type classifier is to determine the diameter of opening in the wood spigot at the bottom of the sorting column.

A novel device for concentration is permitted in the use of a pulsator-jig compartment which is bolted to the bottom of the wood launder the same as the classifier units. This launder jig has a separate pulsator valve but no concentrates discharge gates to adjust. A screen is used in the jig compartment and the concentrates discharge down through the screen into the hutch and out through the opening in a wood plug at the bottom of the hutch. The discharging of the grains

of free mineral through such a launder jig relieves the coarse tables from a considerable burden and reduces the amount of middlings product usually delivered from the coarse table.

Dewatering Devices

Great improvements over former methods have been made in the development of systems for the dewatering of pulps and slimes. Too often pulps are delivered to the concentrating tables in too dilute a condition with a consequent loss of fine minerals.

The dewatering of pulps becomes an important point in the feed to tube mills for it has been demonstrated that a feed pulp containing about 40% moisture gives the best efficiency in tube-mill crushing.

In South African practice the Caldecott diaphragm cone is reported to give satisfaction in large installations where large cones may be employed and the mill feed fairly constant. However, in small mills with fluctuating loads difficulties in adjustment may be met.

The dewatering of jig and concentrating-table feed insures a larger capacity and more complete separation of the various products. Slime-table work is particularly sensitive to the consistency of the pulps fed to the tables, for a thickened slime pulp is necessary for successful recovery.

In districts with low or fluctuating water supply the recovery of water from tailings becomes a serious necessity for use again in the mill system. The Tomboy mill in Telluride makes use of a filter plant for the purpose of reclaiming water from the tailings and furnishes clear wash water for the concentrating tables. The Miami mill in Arizona has an extensive plant of cement settling tanks returning about 75% of the tailings water for use in the mill system.

A serious fault in many mill systems is the great volume of wash water used to sluice the material through the mill system. In many cases the use of too flat launders requires the use of extra wash water which is carried over the jigs and tables instead of eliminating the surplus volume by means of suitable dewatering devices.

Philip Argall, at Stratton's Independence mill, Victor, Colo., uses a double spiral classifier of his invention for the purpose of dewatering tailings sluiced from the mill and uses the reclaimed water for further sluicing operations.

Tube Mills

Great progress is being made in the design as well as the operation of this excellent device for the fine crushing of pulps. The tube mill appears to be the most efficient means for the final reduction to slimes, previous to agitation in cyanide mills.

The use of the scoop feed has overcome the former troubles from wear of packing joints. This simple and automatic feeder receives general endorsement. The spiral lining in the mills using the trunnion feed insures a positive feed to the pebble space of the mill. The heads are usually lined with hard-iron plates and in the trunnion-type mills the lining is swelled out around the feed and discharge openings to divert the falling pebbles away from the heads, thus allowing freer entrance and discharge of pulps.

Silex or natural flint linings 4½ and 6 in. thick are used as well as the hard cast-iron ribbed linings of the El Oro type and other similar designs. The Brown sectional hard-iron and manganese-steel linings give good results in Australian practice.

The use of machine-cut gears on tube mills was first advocated and used in Colorado and now the practice is general. The design known as the tire-and-trunnion type offers advantages in a large-diameter discharge opening of about 20 in., which allows greater capacity and permits more ready access to the interior of the mill. The tire-discharge opening is bushed with a heavy hard-iron reversed spiral which carries small pebbles or oversize grains of pulp back into the pebble space of the mill, only the slime pulps floating out with the water issue through the discharge opening. Provision is made for changing the level of discharge for the regulation of pulp sizes by varying the diameter of the tire-discharge opening.

Tube mills are in successful operation for the recrushing of jig and table middlings for further treatment on fine and slime concentrators. In the Lewis mill Telluride, a 4x10-ft. trunnion-type tube mill regrinds the coarse-table middlings from a 60-ton mill feed in 24 hr. At the Midvale, Utah, mill of the United States Smelting Co. a 5x14-ft. tube mill of the trunnion type recrushes jig and table middlings at the rate of 136 tons in 16 hr., or 204 tons in 24 hr. delivering a product passing a 40-mesh screen with but 10% of slimes finer than 200 mesh.

The tube mill may be used to produce a granular pulp with but a small percentage of slimes for subsequent table work, as well as a crushing device for sliming pulps for cyanide solution. The tube mill is a remarkable all-round machine for fine crushing and there may be further developments which will serve well in our mill systems.

Official statistics show that the world's consumption of nitrate for the first 11 months of 1911 reached 49,000,000 quintals, an increase of 500,000 as compared with 1910. The production from July to November amounted to 23,000,000 quintals.

Smelting Chromiferous Iron Ore

A correspondent in Greece states that there are deposits of chromiferous iron ore extending for a considerable distance in the northeastern part of Greece and on the islands of Eubea and Skyros; the ores have the following approximate analysis: Fe, 47-50%; Cr_2O_3, 2.5-3; Al_2O_3, 9-10%; SiO_2, 7-11. He inquires with regard to the possible elimination of the chromium and to the practice in smelting chromiferous Cuban ores. In discussing the latter points, Bradley Stoughton writes:

In the smelting of chromiferous ores of Cuba in the blast furnace, followed by refining in the basic open hearth, a steel is made which contains about 10% of the original chromium present in the ores, together with the greater part of the nickel.

In other words, about 90% of the chromium is oxidized and slagged off in the basic openhearth furnace. It is a simple matter to slag off all of the chromium if desired, but the steel companies making this material desire to conserve all of that element possible because of the high qualities which it contributes to the steel.

They are able to turn out a very superior product, by virtue of the nickel and chromium which these ores retain, and find a ready market for it in many lines where steel having a combination of high strength and good ductility is demanded; thus, automobile steels and important parts of locomotives and railroad rolling stock are made of this material, which will have properties somewhat as follows:

Tensile strength	83,400 lb. per sq.in.
Elastic limit	62,500 lb. per sq.in.
Elongation in 2 in	8.67%
Reduction of area	49.53%

After different heat treatment, the steel may have properties somewhat as follows:

Tensile strength	162,500 lb. per sq.in.
Elastic limit	152,000 lb. per sq.in.
Elongation in 2 in	16.0%
Reduction of area	56.0%

or else:

Tensile strength	226,000 lb. per sq.in.
Elastic limit	190,000 lb. per sq.in.
Elongation in 2 in	8%
Reduction of area	32%

This steel is used for many different purposes, such as crankshafts, axles, hatchets, axes and other tools, as well as springs. It is now being largely advocated for screw rods and it is said to be an excellent material for wood screws and other screws, and it can be worked with great ease.

It is difficult to see why one would desire to eliminate all the chromium from this steel, but if this be the case, there should be no difficulty in manipulating the openhearth practice so as to oxidize it away.

The Synchron Respiration Apparatus

Artificial respiration is a means used for resuscitating a person who has been drowned, asphyxiated, or shocked by an electric current. Resuscitation of employees is occasionally necessary at mines and it is therefore of interest to note the operation of the Synchron respiration apparatus which has been designed to synchronize the movements of the Sylvester method of resuscitation.

The Sylvester method of inducing respiration consists of three operations:

(1) The patient is laid flat upon his back and his tongue is grasped, drawn forward and held to prevent it from impeding the passage of air through the throat.

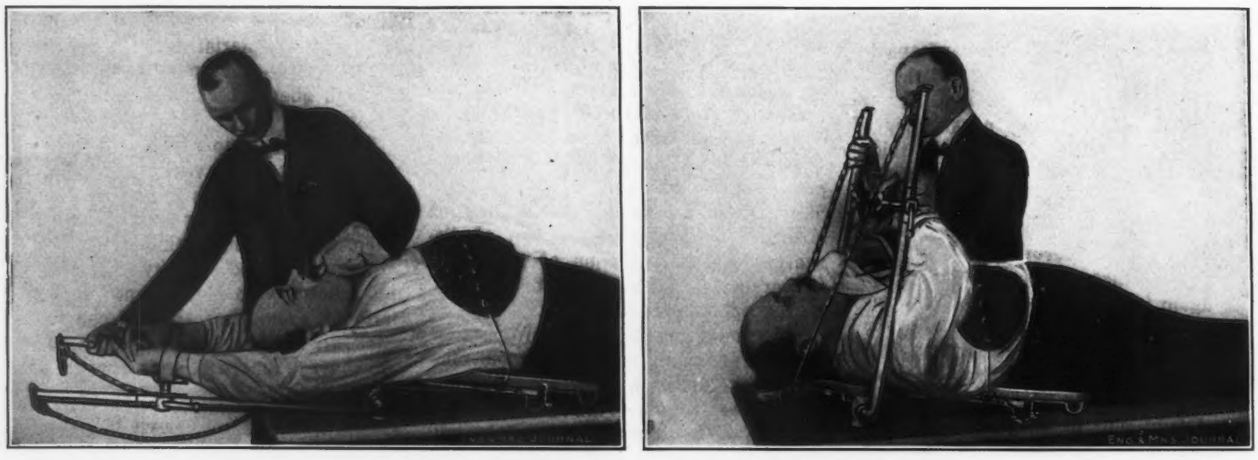
(2) The patient's arms are drawn in a vertical plane upward and backward until they touch the ground beyond his head. The arms are thus held for two seconds, then they are swung in a vertical plane until they lie on the ground parallel to the body. They are held in that position for one second. The first part of this operation expands the chest, tending to draw air into the lungs, while the second operation tends to compress the chest and expel air.

(3) Just before the arms are brought forward parallel to the body, a third attendant who is on his knees astride the patient's hips grasps the body with his hands, the balls of the thumb resting on either side of the pit of the stomach, the fingers falling into the grooves between the short ribs. Now, using his knees as a pivot, at the moment the patient's hands touch the ground he throws, but not too suddenly, all his weight forward on his hands, and at the same time squeezes the waist between them, as if he wished to force something in the chest upward out of the mouth; he will increase the pressure while he slowly counts, 1, 2, 3, 4, or for about two seconds, then he suddenly lets go with a final push, which will throw him back to his position. This completes expiration.

The operations 2 and 3 are slowly repeated, and may have to be persisted in for an hour or more before respiration begins. The Sylvester method requires three attendants, one to hold the tongue, one to operate the arms and one to squeeze the waist. It is hard and tedious work and successful results are rarely obtained in less than an hour, so strong attendants or else a number of men working in relays are necessary.

Dr. Fries, a Swedish physician, has invented the Synchron respiration apparatus to carry out the Sylvester movements but with less exertion on the part of the attendants; in fact, only one is required. The device consists of a board on which the patient is placed and which is raised a little at the head end. The arms are attached by straps of adjustable length to levers made of ordinary pipe. Across the abdomen a girdle or belt is placed which serves to compress the chest and is connected with and operated by the levers. Wires running from the ends of the levers through small pulleys are connected to the girdle by hooks. Several holes at each end of the girdle allow for adjustment. As will be seen, in the accompanying illustration, the three movements of the Sylvester system can be carried out by one man. He holds the levers with his right hand while grasping the tongue with his left. He then alternately swings the levers back over the patient's head, then down so that his arms are approximately parallel to his body, thus carrying out operation 2. The levers operating the wires attached to the girdle compress the belt or girdle when the levers are moved forward, so that the girdle operates as does the third attendant sitting astride the patient's hips in the Sylvester method.

The device has been tested at the Carlinska Institute, Stockholm, Sweden, where Prof. J. E. Johansson has carried out practical experiments in the physiological department; also at the Serafinerlasaret, the Royal Hospital of Stockholm. The appliance has also been adopted by the Life Saving Society and approved by the directors of the Association of Swedish Physicians. At the Royal Hospital, Stockholm, this apparatus proved to be successful in several cases of asphyxiation after manual treatment had been abandoned as hopeless. The Victoria Falls and Transvaal Power Co. has 12 of these machines. It is claimed that respiration can be restored in from one-half to one-third the time usually required by the Sylvester method; the latter is generally regarded as superior to the Schäffer method which is sometimes used; in cases of asphyxiation the Sylvester method is preferred as it causes the respiration of two to three times as much air, provided the prescribed movements are faithfully carried out.



THE SYNCHRON RESPIRATION APPARATUS IN OPERATION

The name Synchron is derived from the synchronous action of the device in tightening the girdle at the same time that the arms are brought to a forward position. It is this synchronous action that is so difficult to secure by manual methods, especially when an unusually protracted period is necessary to restore respiration. The device has been patented and the representative in this country is A. E. Sylven, 29 Broadway, New York.

A recent experiment in copper melting in an electric furnace produced a peculiar physiological action. About 5000 lb. of pure electrolytic copper were melted in a three-phase arc furnace. After a few hours, according to the *Brass World*, all of the 10 men employed experienced difficulty in breathing. For the following 24 hours the men were attacked with a severe nausea, followed by a soreness of the entire system similar to that of acute grippe.

Some Observations in Butte, Mont.

By W. R. Ingalls

It is considered to be a rational forecast that these mines of surpassing magnitude will maintain their present rate of production for 20 years to come and that the cost of production will be reduced to 9c. per lb. of copper by improvements in the mining and smelting practice.

Every time I visit Butte I obtain a deeper impression of the wonderful magnitude of its ore deposits. There is no other copper-mining district of the first order, unless it be Bingham, where the zone of mineralization is so compact. We speak of Lake Superior as being a single district, and indeed it is, but its mines are scattered through a belt several miles in width and 30 miles or more in length, with long reaches of barren country intervening between productive mines. We talk about Arizona displacing Montana as the premier copper-producing state, which is true, but disregards the fact of its production coming from five widely separated districts of the first class, besides many others of less importance. On the other hand, Montana is Butte and Butte is Butte Mountain, wherein the whole group of productive mines is compassed by about three miles in one direction and two in the other.

Within this area of Butte there is a thick and intricate system of lodes; so thick and intricate that they form a network. There is an original system of parallel lodes, which later were faulted by a transverse system, also mineralized, and then the whole arrangement was faulted some more, after which other things happened. All of this is a story for the geologists to tell. I shall undertake to do no more than to express my appreciation of the mystification of the older miners in their exploring ventures and my admiration of the first engineer, I believe it was Mr. Brunton, who perceived that here was a case where the miner needed the assistance of the mining geologist. Undoubtedly the studies that were made in connection with the protracted litigation contributed to the recognition of this principle. Anyway, the Anaconda Copper Mining Co. has for many years enjoyed the services of the best organized geological department, now under the direction of Mr. Sales, that I know of, and it is not immoderate to say that it would not know how to get along without it.

In the popular mind the mines of Butte, which is now substantially equivalent to saying of the Anaconda company, have suffered perhaps by comparison with the claims made for the newer porphyry mines. The position of the orebodies of the latter has permitted their rapid delimitation by the relatively cheap method of churn drilling. During their development the monthly additions to ore reserves have been heralded as if they were dividends. Of course, it is satisfactory to know that the life of a mine is assured for a long period of years and estimates of value are greatly facilitated with such knowledge. Because the same data are not available respecting the lode mines is not, however, good ground for throwing doubt upon them. That lode mines may have a long life is amply illustrated by the history of those at Lake Superior and at Butte. There are many of such mines in which much greater reserves of ore could be shown if there were any good reason why that should be done. On the contrary, the reason is the other way. Such a mine must keep its development of ore sufficiently ahead to insure maintenance of its normal rate of production and be prepared to make quickly an increase if market conditions should indicate that desirability. Further than that development is uneconomical because of the loss of interest upon the money expended in it and the cost of keeping in repair the work that represents the principal, besides which there are other objections.

If all mines were valued upon the basis of delimited ore, there would be relatively little interest in the mining business. Nor is it to be inferred that the chances for ore beyond what has actually been put in sight cannot reasonably be valued. There are some valuable mines, Batopilas for example, which sometimes do not show any ore at all.

Some years ago I had come to have a rather unfavorable opinion of Butte, in common with other engineers. This was based chiefly, I think, upon the gradually diminishing grade of the ore, the idea that such impoverishment might be expected to increase with further depth and the fear that the increase in the difficulty of mining would probably offset the advantages gained from technical improvements. These ideas were inspired and fostered by the statistics in the company's annual reports. They have been wholly dispelled by observation and reflection during the last four years.

The copper production of Butte since 1881 has been about 5,600,000,000 lb. The veins did not become productive of copper until a considerable depth below the outcrops had been reached, the copper having been leached from the superior portions. The depth at which copper mining began varied, but on the average it was perhaps at about 200 ft. It cannot be said definitely to what depth the veins have now been exhausted on the average, or rather what horizontal section of the block, about two by three miles, containing all the veins is represented by the total production of copper, but this is perhaps comprised between the horizons of — 200 ft. and — 1600 ft.; i.e., the total production of copper has come from a block of country about 1400 ft. in depth. Even if this figure be considerably in error, the reasoning which follows will not be seriously invalidated. I do not mean to imply that the veins have been stoped out to the depth of 1600 ft. and merely explored below that depth. On the contrary, much ore has been produced from below that horizon. On the other hand, much ore is still being mined from above it. But it is assumed that what has been taken from below 1600 ft. is offset by what remains above.

On this assumption of ore extraction from a block of country 1400 ft. in depth, the total copper production of Butte has been about 400,000,000 lb. per 100 ft. of depth. In recent years the normal production of Butte has been about 300,000,000 lb. per annum. In the making of that production the ore is exhausted from about 75 ft. vertically. In order to maintain that rate for 20 years the mines will have to be worked out to the depth of 3100 ft. This is, of course, upon the assumption that the ore becomes neither richer nor poorer than it has averaged heretofore. The depth of 3100 ft. does not *ipso facto* present any extraordinary mining difficulties; nor does an expectation that payable ore will extend to that depth either stretch imagination or violate reason.

What, then, is the ground for such an expectation? Simply that the mines have been rather extensively opened to the depth of 2400 ft., and in at least one mine 2800 ft. has been attained and no diminution in the grade, size or character of the orebodies has been observed. For example, ore averaging 6% copper and 12 ft. in thickness has recently been exposed for 2500 ft. in the Gagnon vein on the 2400-ft. level. It is not an unreasonable expectation that the Butte veins in general will maintain their mineralization to the same depth that has already been shown in several of them.

The occurrence of chalcocite in the ore of Butte has been the subject of much study and discussion. At first it was thought to be due to secondary enrichment from above in the usual way. When it continued to be found at depth below where it ought to be, geologists began to talk about the possibility of secondary enrichment from below, although they failed to make it clear how that could come about. There is now a strong be-

lief, perhaps I ought to say proof, that the deep chalcocite of Butte is a primary form of the mineral. The importance of this in forecasting the life of these mines is, of course, obvious.

PRODUCTION OF COPPER IN MONTANA

(As reported by "The Mineral Industry")

Year	Lb.	Year	Lb.
1882	9,058,000	1897	237,158,540
3	24,664,000	8	216,979,334
4	43,093,000	9	237,953,951
5	67,797,864	1900	254,460,713
6	57,611,485	1	229,870,415
7	78,700,000	2	266,500,000
8	98,504,000	3	272,555,854
9	104,589,000	4	298,314,804
1890	110,955,733	5	319,179,880
1	112,359,839	6	299,850,000
2	161,051,477	7	226,290,873
3	154,300,100	8	252,558,330
4	183,094,755	9	313,838,203
5	196,768,925	1910	286,242,403
6	228,958,164	11	273,438,879
Total			5,614,698,521

The extraordinary development of the mines of Butte that has been effected during its history of 30 years has afforded a facility of ore extraction that few of the younger mining districts possess. This was exemplified a few months ago, when it became desirable to increase the production. For about 18 months previously the production had been curtailed to the rate of about 22,000,000 lb. per month. In December last it was decided to make an increase of about 4,000,000 lb. per month. It was only necessary to give the order. In one month the desired increase was made. Such an ability manifests, of course, not merely a wonderful mine development, but also a wonderful organization for operation.

The latter is to me the next most impressive thing about Butte. I am here again using the term Butte as interchangeable with the Anaconda Copper Mining Co., the two being substantially equivalent. There was a time when another name, the Amalgamated Copper Co., was not wholly in good repute, but even amid the quarreling and wire-pulling of the evil days of litigation, the verdict of history will be that the Amalgamated after all was more virtuous than its assailants, and whatever may have been disagreeable in certain phases of its management, there never was any question about its sincerity and efficiency in building up an industrial organization which gradually became a thing to make the mining industry and the country proud. The backbone of this has been the staff, selected for competency alone and kept permanently. Changes in the Anaconda corps are rare. Under Mr. Thayer, the president, Gillie, Mathewson and Goodale, with their own able assistants, have made the Anaconda's the show mines and works of the West, not merely in appearance but essentially for what is done in them. The miners have been leaders in the introduction of improved methods, even if their work is less prominently in evidence than that of the smelters, whose progress has been spectacular in the development of gigantic blast and reverberatory furnaces and numerous other things of economic advantage.

The effort to do things better and cheaper has been going on ever since the Amalgamated got fairly into operation. It is no new thing inspired by porphyry or any other kind of competition. It is the natural outcome of the inspiration of an organization superior to most organizations in the mining business, and, as is always the case with organization, the beginning had to be made many years ago. The results have lately been showing in an impressive and very material way, namely, in the reduction in the cost of production, which has been upward of 1c. per lb. of copper during the last four years.

Nor is there any evidence that the management expects ever to say that its work has been done, that perfection has been achieved, and consequently that it may go to sleep. Among the improvements of the first order that are now being carried out are the introduction of electric tramming underground, the changing from steam to electric-compressed-air hoisting, and the electrification of the Butte, Anaconda & Pacific railway and its branches. These consummations are the results of studies begun some years ago. In the engineering and experimental departments studies are now going on that will materialize some years hence. It will not be surprising if at some time the Anaconda cuts its cost of producing copper down to 9c. per lb. It is a long way from being relegated to the rear by the porphyry mines.

Pumping Plant at Sloss Iron Mines, Alabama

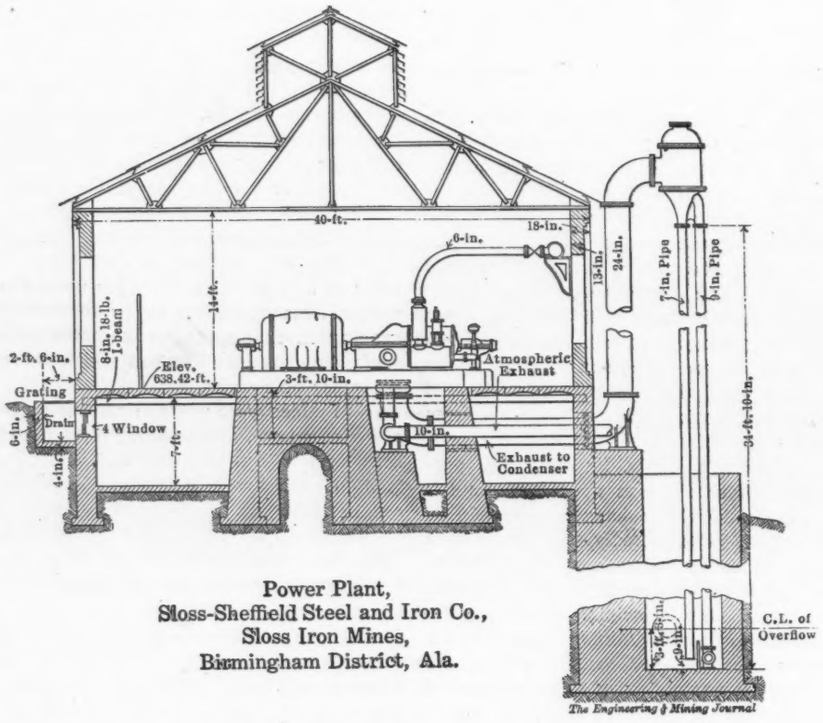
By C. A. Tupper*

To provide a modern electric generating plant solely for the purpose of keeping a mine free from water is unusual; but this was done by the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., at what are known as the "Sloss" workings on Red Mountain in Jefferson County.

Heavy Intermittent Inflows of Water

Included in these workings are two slopes of about 23° pitch. The lower, designated as No. 1, is 2400 ft. southwest of No. 2. Both lie directly across from Bessemer, Ala., about 1½ miles distant. In common with other slopes on Red Mountain much trouble was caused by heavy inflows of water, that usually broke in from the overlying strata through fractures in the hanging wall. These occasional floodings were originally of relatively short duration, and little difficulty was experienced during most of the year in keeping the workings dry.

In 1909-10 the condition of No. 1 mine was greatly impaired by heavy falls of top rock, which opened up numerous channels of water and forced a shutdown of the mine. Additional pumps and the necessary pipe lines were installed, but the flow of water was so steady and of such great volume that the direct-



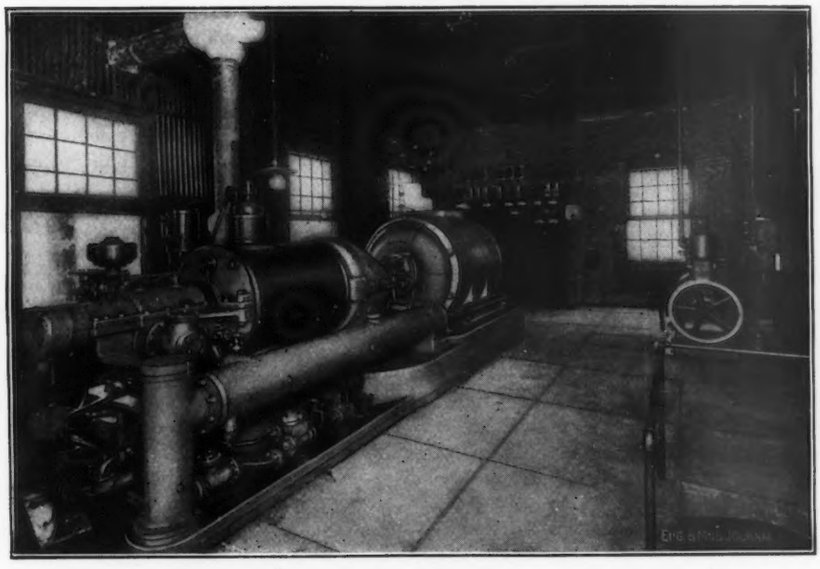
Power Plant,
Sloss-Sheffield Steel and Iron Co.,
Sloss Iron Mines,
Birmingham District, Ala.

*Consulting engineer, 389 Thirty-first Ave., Milwaukee, Wis.

acting steam and air pumps proved inadequate. Consequently, F. W. Hausmann, mechanical engineer of the company, in conjunction with M. J. Lide, consulting engineer, prepared the plans for a complete electrically driven pumping plant.

Steam Turbine Generator Used

This pumping plant comprises a power house, in which is installed a steam-turbine generator unit of 750 kw. capacity, and an underground pumping station equipped with two 10-in. 4-stage centrifugal pumps, each direct-connected to a 450-hp., three-phase, 60-cycle, 2200-volt, squirrel-cage induction motor. The turbine, which operates at 3600 r.p.m., is supplied through a 6-in. feeder with steam at 125-lb. gage pressure from a battery of water-tube boilers. In its various details standard practice is followed. A three-phase, 60-cycle, electric current is delivered by the generator at



Power Plant for Electric Pumping at Sloss Mines

2300 volts. Excitation of the field is from an engine-driven, direct-current generator of 15 kw. in starting and from a motor-driven set of the same size while running. The switchboard consists of an exciter panel with Tirrell regulator, a generator panel and two induction-motor panels.

The turbine is operated condensing, as shown in the accompanying engraving, and the arrangements for this are particularly interesting. All of the water pumped from the mine is discharged into a large circular concrete reservoir, with suitable gates for excess flow, situated on the side of the mountain above the power house. From this reservoir injection water at 60° F. is drawn to a 36-in. Tomlinson barometric condenser, which maintains a vacuum of approximately 28 in. referred to a 30-in. barometer. The piping and other arrangements at the power house with provision for atmospheric exhaust when desirable, may be plainly seen in the illustration.

From the switchboard the alternating current generated is carried to the mine opening by means of three-phase overhead transmission and thence through three-conductor, lead-covered, steel-armored, 2300-volt cable to the pump motors.

All Motors Started From Power House

For convenience in operation, the engineers' plans provided for starting the motors and stopping them directly from the power house. To this end the induction-motor panels were equipped with hand wheels in the switchboard, working, by means of suitable gearing, in connection with auto-starters situated in the basement. In addition each motor is provided with an emergency oil switch, so that, in the event of an accident, the operator in the mine is not dependent upon the power-plant engineer to enable him to shut down. There is also, however, direct telephone communication. In starting, a pump motor can be brought up to full speed quickly, with the other motor either running or shut down, and the momentary fluctuation in voltage is slight. The turbogenerator can also be heavily overloaded.

The underground pumping station and a permanent sump of 1,500,000 gal. or more, are situated about 1600 ft. from the slope mouth. At this point the pumps have to operate against a total vertical head, including suction, of 655 ft. They were originally installed in gradually advancing positions, the mine being emptied of water in five weeks' continuous pumping. The present station was then constructed and has fulfilled every requirement. The rated capacity of each pump at 1130 r.p.m. is 1800 gal. per minute.

Electrically, there was some difficulty at the start. As is customary in systems containing a combination of overhead and underground circuits, high potentials occurred, due to resonance effects, which on several occasions produced pin-hole punctures in the insulation of the motor-stator windings. This difficulty, however, was remedied by grounding the neutral of the generator and installing aluminum-cell, electrolytic-type lightning arresters.

For the illustrations and data on which this article is based, I am indebted to Jesse Adkins, Birmingham manager of Allis-Chalmers Co., which built the power and pumping machinery, and to F. W. Hausmann, engineer of the Sloss-Sheffield Steel & Iron Co., Bessemer, Ala.

Giroux Consolidated

During the year ended Dec. 31, 1911, the Giroux Consolidated Mines Co. increased its real property holdings by the addition of two placer claims, and its stock holdings in the Butte & Ely Copper Co. were increased to a total of 249,575 shares.

Alpha Workings

On the 1000 level of the Alpha shaft, 571 ft. of drifting were done to provide a safe connection between the Giroux shaft and the Alpha workings and to test the ore deposits. The ore was found to be black melaconite, cuprite and malachite. On the 1200-ft. level, 909 ft. of drifting and crosscutting were done; the ore on this level occurs as cuprite, carbonate, black oxide and metallic copper. On the 1400-ft. level, which was sunk to during the year, it is stated that, while the ground is heavy, it is all right when drained; it is claimed that if this shaft were sunk to the 1600 and the 1400 level then drained, there would be no trouble. Another method suggested for working this ground is to drive several drifts on the 1400 and to keep changing as each in turn gets too wet and heavy to carry forward. The total drifting done during the year amounted to 3016 feet.

Giroux Shaft

The Giroux shaft was completed to the 1400 level; since then the shaft has been sunk and fully timbered to 40 ft. below the 1400 level, making 180 ft. of shaft work done during the year. A station was cut and timbered at the 1400 level. One 600- and one 1200-gal. Presscott, cross-compound condensing pumps, on the 1200 level, were started in January, and one 800-gal. Prescott, duplex-compound condensing pump was started on the 1400 level in May. By Dec. 13, the water had been lowered to a point within 33 ft. of

the 1400 level. Each of the two bailers in use holds 1750 gal., or 7.3 tons of water, and 1028 bailers have been brought up in 24 hours, making an average of 1249 gal., or 5.21 tons per min. On Jan. 16, 1912, the 1400-level pump was started with air, the 1200-level pumps with steam and one bailer was also used. It is hoped soon to have the water out.

The Giroux Shaft Fire

On Aug. 21, at 9 p.m., a fire broke out in the Giroux shaft, which resulted in the loss of seven lives. It is stated that the manner of occurrence of this fire will never be known, as the three survivors were working at the bottom of the shaft and can tell nothing except that the shaft was on fire as they were hoisted through it. Evidence shows that the fire started on the 1000 level, where no work was going on. This station was all burned out, and the shaft was damaged for some distance above and below this point. The pump station on the 1200 level was not damaged, nor were the steam pipes and water-column pipe in the shaft.

Porphyry Ore Mines

The Morris-Bunker Hill orebody is being opened for production. The wooden headframe used at the Giroux shaft before the steel one took its place has been erected at the Morris No. 2, which is a three-compartment shaft, 205 ft. deep. The engine house has been finished and the foundation is now being put in for the first-motion hoist, formerly used at the Giroux shaft. The boiler house is nearly completed and contains one 6x16-ft. tubular boiler, two 5x16-ft. tubular boilers and one 4½x14-ft. tubular boiler; these are set up in position, ready to be bricked in. Until machinery is in operation it will be impossible to retimber the old drifts or to drive new ones in the mine, but this will be done soon, and mining is expected to be in progress by May 1. It is stated that the grade of the ore to be shipped from this mine will average more than 2 per cent.

Three churn drills were worked, during the first part of January, near the Nevada Northern Ry., and north of the main shaft of the Butte & Ely Copper Co. It was necessary to shut these down, however, on account of the weather and further work has not been resumed. Twelve holes and 1930 ft. of drilling done there in 1911, disclosed an additional tonnage of porphyry ore. Some additional ore tonnage was shown on an extension of the Morris orebody; in all a total of 2650 ft. of drilling were done during the year.

Geology

Discussing the geology, the late J. A. Snedaker said:

> The installation and equipment of the Giroux shaft at present is nothing more than one of the preliminaries or initial work to explore the deeper levels of the ore zones of that particular portion of the property. The Giroux property, I believe, presents features different from any other copper-bearing territory existing in the United Sattes, and that is, it has two series of ore measures to develop. The first, and easiest to prove up, has been partially developed and has placed a great many million tons of the concentrating character of ore in sight. The second, in which the deep-level ore measures are found and in which the Alpha mine is situated, occurs in the large contact fissure between the eruptive and sedimentary, following along the southern border of the Giroux property for a distance of something over two miles in length. This Alpha vein presents croppings that are exposed on the surface hundreds of feet in width; and, as the leaching is very deep, it is requiring work of large magnitude and equipment commensurate with the size of the vein to prosecute this development.

At present about 1,000,000 gal. of water per day are being pumped at the Giroux shaft and the work in the Alpha territory has shown that there is a permanent and ample water supply, available at a minimum expense, to enable the operation of a concentrating plant that will treat a tonnage per day several times in excess of the present concentrating capacity of 500 tons per day.

Contract for Ore Treatment

The report states that it was decided recently to start the production of porphyry ores first and thereby to put the company in position to sustain itself and carry on development from its own resources. Arrangements have been made to commence shipment of porphyry ores on or before May 1, after which it will be possible to carry on both production and development simultaneously.

It is stated that the directors in October and November, 1911, seriously considered enlarging the present concentrating plant, of 500 tons capacity, to one of a daily capacity of from 1000 to 1200 tons. It was found, however, that this would require at least eight months' time. A contract has, therefore, been negotiated with the Steptoe Valley Mining & Smelting Co. for the treatment of ore from the Morris-Bunker Hill mine. This contract covers a term of five years commencing May 1, 1912, and provides for a daily treatment of from 900 tons minimum to 1200 maximum of crude ore. The Steptoe company will transport and treat the ore, and arrange for the refining. It is estimated that refined copper can be marketed and produced for about 9½c. per lb. The report states that there are 4,010,000 tons of porphyry ore fully developed in the Morris-Bunker Hill mine, of an average assay value of 2.14% copper; further that at this mine there is also a large quantity of partially developed ore, the tonnage of which will undoubtedly reach several million tons, of at least an average assay value of 1.73% copper. Attention is called, in the report, to the fact that on a basis of shipping only ores averaging 2.14%, more than 10 years' ore supply, with the maximum daily production contemplated by the above contract, is now blocked out at this mine.

Estimates of Ores

During the year, additional drilling and other work has made it possible to make more accurate and definite calculations as to tonnages and grade of the porphyry ores. The various orebodies, as far as developed, have been reblocked and sectionalized, and the tonnages and grade recalculated. While not including anything for possible additional tonnages, likely to be shown as development work progresses, it is estimated that there are at present 10,291,000 tons of fully and partially developed ore of an average copper content of 2%, and in addition thereto, 6,599,000 tons of fully and partially developed 1.65% ore. In addition to the tonnage of developed and partially developed ores, and not included in those estimates, a large quantity of lower-grade ore is said to have been disclosed, the average assay value of which will be more than 1% copper. The foregoing estimates are stated to have been calculated in the usual way and not on the basis of net recovery. In calculating the tonnages, the factor of 13 cu.ft. of ore in place is taken as 1 ton.

The financial statement shows: Cash on hand, Jan. 1, 1911, $151,026; sale of first-mortgage bonds, $252,000; miscellaneous receipts, $18,139; total, $421,165. Among the expenditures the following figures are of interest: Nevada mines expenses, $198,706; Nevada mines construction, $70,488; Mexican mines expenses, $7116; Mexican mines construction, $347. On Dec. 31, 1911, the cash on hand amounted to $137,309. Not the least interesting item is that of $34,521, which is given as the cost of putting out the fire and getting the Giroux shaft ready for repair, repairing the shaft, station, pockets and drifts, and bailing and hoisting the water from the date of the fire.

Shaft Sinking by Freezing

Regarding shaft sinking by freezing, it is stated (*Echo des Mines*, Feb. 15, 1912), that if the water to be encountered is known to be less than 1000 to 1500 gal. per min., it will pay to follow the old system of pumping, but if it exceeds 3000 to 3400 gal. per min., it will certainly pay to freeze. Between these extremes the methods are more competitive, and dependent on local conditions. The estimate is given that for a pair of 18-ft. diameter shafts, sinking them simultaneously by freezing, the cost will be about $87,500 for 300 ft.; $140,000 for 600 ft.; and $250,000 for 120 ft.; all costs, including the refrigerating plant, being included.

Ore Dressing in the Joplin District—IV

By James L. Bruce*

In the discussion of milling costs, amortization and operating charges are separately considered. The cost of a complete milling plant is given at from $800 to $1200 per ton of capacity per hour. The principal operating expense is for labor.

*General manager, Continental Zinc Co., Joplin, Mo.

Before going into a discussion of the cost of milling the expression should be given some definition and elaboration to show just exactly what operations are included. I will divide it under two heads to show the first cost and the cost of operating. (1) Amortization charges to milling. (2) Operating charges to milling.

The first is one which many superintendents or managers have no control over for various reasons, but a consideration of it is nevertheless of much importance when considering the initial expenditures for mining. Money invested in mill plant beyond any nominal amount is expected to give either greater capacity, better recoveries or cheaper operating costs. Low amortization cost then usually means high operating cost and *vice versa*. Apparently the most advisable investment would be that which gave the lowest total for amortization charges, interest, and operating costs, also considering any increase in profits from better mill recoveries which might be anticipated from an extra investment. This, however, is complicated by the interdependence of the milling with the mining plant and operations. The most profitable rate at which to mill a certain quantity of ore may not be the most profitable rate at which to mine the same quantity. The size of the mill then is dependent on both, and should be chosen to fulfill an average of the two conditions.

COSTS PER TON FOR CULLING AND MILLING IN THE JOPLIN DISTRICT

Year	Tons Hoisted	Labor, Cents	Fuel, Cents	Hard Iron, Cents	Belts, Cents	Repairs to Machinery, Cents	Iron and Steel, Cents	Lumber, Cents	Elevator Cups and Bolts, Cents	Jig Grates, Cents	Oils, Cents	Water for Power Plant, Cents	Supplies and Repairs for Power Plant, Cents	Pipe and Fittings, Cents	Miscellaneous Cents	Total, Cents
1908.....	83,603	10.95	3.17	3.63	2.06	0.25	1.60	0.41	0.53	0.26	0.40	0.33	0.00	0.35	3.44	27.38
1909.....	108,728	10.24	3.25	3.24	1.67	1.45	1.08	1.06	0.82	0.25	0.40	0.28	0.28	0.12	1.36	25.50
1910.....	152,164	9.44	2.68	2.95	1.25	1.39	0.70	0.45	0.61	0.57	0.32	0.20	0.37	0.12	0.99	22.04
1911, 11 months.	158,562	9.26	3.42	2 82	1.29	1.36	0.67	0.57	0.43	0.57	0.24	0.26	0.34	0 07	0.53	21.83
Averages.....		9.80	3.11	3.16	1.48	1.21	0.91	0.61	0.59	0.47	0.32	0.26	0.28	0.14	1.35	23.61

Profit and Amortization Defined

The terms "profits" and "amortization" are often incorrectly used and I think it well here to call attention to the definitions given in the "Standard" dictionary. Profit is defined as "the return from the employment of capital after deducting the amount paid for raw material and for wages, real or estimated rent, interest, insurance, etc." From this it is clear that a nominal interest on the capital should not be regarded as profit, but should be considered as part of the costs of conducting the enterprise.

Amortization is defined as "the extinction or reduction of a debt through a sinking fund." We can consider this debt as being the amount of the capital invested, while the yearly interest on the same is charged to costs, in which case accumulation of the sinking fund should be equal at the end of a certain period to the capital invested. Or we can consider the debt as being equal to the capital invested plus the accumulations of compound interest on the same, in which case the accumulations of the sinking fund should be equal to the debt as described. Or again a fixed yearly sum may be provided, part of which is used to pay interest while the remainder is used to retire part of the capital invested, which together with the yearly interest, thus gradually becomes less. If the rate of interest which can be realized on a sinking fund is the same as the rate which should be charged to capital invested, it makes no difference which of the above methods is applied, the yearly charges will be the same.

If we wish to find the yearly amount of a sinking fund which will retire the capital invested, P, together with compound interest on the same at a rate, r, in a certain number of years, n, we find that the debt at the end of the period will be $P(1+r)^n$. If the sinking fund can be invested at a rate, t, the annual amount, S, necessary to provide for the debt will be

$$\frac{P\,(1+r)^n\,t}{(1+t)^n-1}$$

If r is greater than t the annual sum should be used to pay interest on and retire the capital invested.

The cost of a mill plant including mill hopper, mill buildings, mill machinery, elevators, spouting, tailings dumps, flumes, mill ponds, etc. and its proper proportion of the cost of power plant will run from $800 to $1200 per ton of capacity per hour and the latter figure is not too high for most plants. When running single shift for 220 hours per month the cost of plant per ton handled per year would be from 30 to 45c. When running double shift the cost of plant per ton per year would be from 15 to 22.5c. The rate of amortization of these costs would depend on the probable life of the mine. Let us assume that the capital invested and the sinking fund are each worth 5% interest. Then if there was enough ore to run the mill five years on double shift the amortization would amount to from 3.5c. to 5.2c. per ton of dirt handled.

For the purpose of illustration I will assume; that there is a 10-acre tract of sheet-ground containing approximately 300,000 tons of crude ore available for milling; that a mill of 20 tons capacity per hour can be built for $24,000; that a mill of 30 tons capacity per hour of equal efficiency can be built for $30,000; and that one of 50 tons capacity can be built for $47,500.

Assuming 5000 hr. running time per year, the first would exhaust the ore in 3 years, the second in 2 years and the last one in 1.2 years, provided the mine would supply them. The average operating expense for the first mill would be about 21c. per ton, for the second about 19c. and for the third about 17c. Amortization charges would be 8.93c., 10.9c. and 17c., respectively, with interest at 6%, and the total cost would be 29.93c., 29.9c. and 34c., respectively.

From this it would appear that both of the first mills could be expected to give about the same total costs. Choice between them should then be made by considering the most economical rate at which to mine, and also the time necessary in either case to develop the mine to the point of economical production. The time required to develop a mine to a large tonnage is usually considerable, and the operating expenses, during the de-

velopment period and until the tonnage can be brought up to its requirements, are much higher with a large plant and equipment than with a small one. On the other hand quick exhaustion cuts down many costs such as pumping, superintendence and general expenses.

Mill Operating Costs

Under the second heading "operating charges to milling" there is a good deal of leeway possible regarding the operations which should be included. I will include the cost of culling out the waste from all the rock hoisted, the cost of all crushing, concentrating, mill and pond pumping, building repairs, carpenter and blacksmith work, power, and disposal of tailings. The cost of culling is charged at some plants to mining but as it is part of the concentration I have included it in the cost of milling, and have figured the milling costs on the tonnage of dirt hoisted from the mine. It is impossible from the ordinary cost-keeping record to get an average cost per ton of any item of supplies such as dirt-roll shells, return-roll shells, smiddem-elevator belting, tailings-elevator belting, pump impellers, etc., except where such records have been kept in great detail for a number of years, because they do not take account of the length of time such service was rendered for each item charged.

For the purpose of knowing just what the cost per ton is for each of the principal wearing parts in the mill, I have kept for about three years a "service record" which shows briefly the dates on which principal supplies in the mill are replaced by new ones, together with the specifications of the article put in service and its cost. This gives the period of service and by referring to other records, the tonnage handled during this period. These amounts together with the cost of the article, are filed in columns provided for that purpose and the cost per ton of ore handled, readily ascertained. I have made it a practice to keep these records for the following principal wearing parts: stationary breaker jaws; movable breaker jaws; left side plates; right side plates; dirt-roll shells; No. 1 return-roll shells; No. 2 return-roll shells; trommel-screen jackets; dirt-elevator cup belt; return-elevator cup belt; smiddem-elevator cup belt; chat-elevator cup belt; sand-elevator cup belt; tailing-elevator cup belt; shaking-screen jackets; centrifugal-pump impeller; jig-grate records on each cell of each jig; records for each drive belt; top and bottom elevator pulleys.

THE CONTINENTAL ZINC CO.

ESTIMATED DRY WEIGHT LEAD ORE 3920
ESTIMATED DRY WEIGHT BLENDE 7870
HOURS MILL RUN 6 hr. 40 min
TONS DIRT HOISTED 661 CARS CULLS 59

Mill Log Sheet for Day Shift Dec. 11 191

RUN From	RUN To	SHUT DOWN From	SHUT DOWN To	CAUSE	RECORD OF SHELLS, JAWS, SIDE PLATES, SCREENS, BELTS, ETC. Parts	Location	Supplied by	Weight or Size
		7.00	9.30	Put new spider, begin trommel				
				Put patch on trommel screen jacket				
				Drive pulley to dirt elevator broke				
				when mill started and had to				
				put on new one	Pulley	Drive to dirt elevator		16x8x3 7/16 Woodpulley
9.30	10.40							
		10.40	11.30	Put new pinion on dirt rolls.	Pinion	Dirt rolls	United Iron Works	
				Put in new movable jaw in breaker	Jaw	Movable	Central Foundry Co.	18 in.
11.30	5.00							

PRODUCTION OF ORES

BLENDE - WET WEIGHTS Rougher and Cleaner	Sand Jig	Tables	Total	LEAD ORE - WET WEIGHTS Rougher and Cleaner	Tables	Total	
7390		1590	8980	3860	480	4340	
Less							
Moisture 920		190	1110	380	40	420	
					440		
6470		1400	7870	3480		3920	

The Engineering & Mining Journal

The head mill man turns in to the office daily a record of mill production, actual running periods together with delays and causes of delays, and the size and specifications of any new material or supplies used in the mill showing where they were used. This is shown in the accompanying record sheet.

The following costs given from a four years' record of a sheet-ground mine will illustrate the distribution of such costs. They do not represent normal costs for this character of dirt or for a mill of the capacity given as the mine and mill water during the last 3½ years has been bad with acid which has doubled or trebled the average cost for elevator cups, screens, and screen jackets, jig grates, spouting, elevator pulleys, plunger stands, faucets, pump impellers, etc., and has added much to the hard-iron costs. The great amount of additional time required for making repairs and changes has added at least 15% to the normal costs for labor.

Labor Principal Cost Item.

Referring to the accompanying table of costs, the principal item, that of labor, has ranged in four years from 9.26c. per ton to 10.95c. per ton, with an average of 9.8c., of this about 20% or 1.96c. per ton was for culling out waste, about 59% or 5.78c. was for mill foreman and millmen. About 9% or 0.88c. was for a proportionate part of the labor costs in the power station, about 8% or 0.78c. per ton was for carpenters and 4% or 0.40c. per ton was for blacksmith and miscellaneous labor. Lower labor costs could be secured at the sacrifice of mill efficiency. The second item in importance, fuel, has cost from 2.68c. to 3.42c. for the four years, with an average of 3.11c. per ton of dirt handled. A corliss steam engine running noncondensing and indicating from about 130 to 150 hp. is furnished with steam from fire-tube boilers fired with natural gas at 12½c. per M for about six months in the year and mine run coal at $2.30 per ton at the boilers for the other six months.

The third item, hard-iron, has cost from 2.82c. to 3.63c. with an average of 3.16c. per ton. The price of the castings during most of this period has been 2½c. per lb. with a credit of ¾c. per lb. for scrap returned. The rock is a hard sharp flint or chert and exceedingly abrasive. Manganese- and chrome-steel castings have been tried but did not last enough longer to repay the extra cost. Some saving in the consumption of hard-iron was effected by feeding the oversize from the trommel to the re-

turn rolls without any water. The fourth item, belts, ranged in cost from 1.25c. to 2.06c. and averaged 1.48c. per ton. About 90% of this amount was for cup belts in wet service, the remainder for drive belts. Cup belts were tried in all grades of belting from the sewed canvas belt to rubber belt purchased at net list price. The rubber belts purchased at prices ranging from 50 to 60% off list have given the most economical service, and dirt-elevator belts of 10-ply material though running on only 30-in. pulleys have proven more economical than the 8-ply belting customarily used. The life of wide belts has been increased by using cups of only half of the width of the belt and mounting them alternately at the opposite edges of the belt. The four items mentioned above constitute about 75% of the cost of milling.

Repairs to machinery have ranged in cost from 0.25c. to 1.45c. and have averaged 1.21c. per ton of dirt. About 0.30c. of this is for repairs to rolls, including replacement of worn out gear wheels, etc., and about 0.16c. is for repairs to crusher. Iron and steel costs varied from 0.66c. to 1.60c. and averaged 0.91c. per ton. About 0.27c. was for screen jackets and 0.22c. for lining for mill launders. Other costs for elevator cups and bolts, jig grates, oils, supplies and repairs for power plant, water for power plant, pipe and fittings and miscellaneous items are shown by the accompanying table.

For some of the drawings used for illustrations I am indebted to the United Iron Works and the Webb City & Carterville Foundry and others, and I wish to express my appreciation of the courtesies extended to me by them.

Mining in Rhodesia

JOHANNESBURG CORRESPONDENCE

The Rhodesian mining boom has passed and the country is suffering the usual relapse in mining and business activity; nevertheless the output shows progressive increase as follows: 1907, 2,178,886 oz.; 1908, 2,526,000 oz.; 1909, 2,623,708 oz.; 1910, 2,568,198 oz., and for the first 11 months of 1911, 2,429,869 ounces.

In general the smaller mines are showing signs of exhaustion, but several important mines are being opened on a large scale and promise to maintain their production. The last report from the Shamva mine shows that the orebody has been pierced at the second level from No. 4 adit. The width is 205 ft.; the unreduced average assay is 21 dwt., or with high assays reduced, 10 dwt. In two other crosscuts the ore is 100 to 140 ft. wide and the reduced assays vary between 4½ and 5 dwt. The deposit has been cut at the third level, or about 400 ft. from the outcrop; the ore assays 5 dwt. The two largest corporations operating in Rhodesia, the Rhodesian Exploration & Development Co. and the Consolidated Goldfields of Rhodesia, have decided to amalgamate. The death rate of natives employed at Rhodesian mines is 15.91 per 1000. The tin discoveries have so far proved disappointing.

Gold Dredge Installations During 1911

BY JOHN TYSSOWSKI*

There were 24 gold dredges erected in North America in 1911, distributed as follows: Alaska, 9; California, 8; Canada, 2; Idaho, 2; Montana, 2; South Dakota, 1. These figures are verified by information from manufacturers; the totals, however, include several dredges reconstructed or built previously but first operated in 1911, as will be seen by reference to the accompanying table. The total digging capacity represented by the new dredges is approximately 3,147,000 cu.yd. per month. The digging capacity of the 24 dredges installed in 1910 was approximately 2,745,000 cu.yd. per month.

NORTH AMERICAN DREDGE INSTALLATIONS IN 1911

Locality	Operating Company	Bucket Capacity, Cu.Ft.
Alaska (9):		
Solomon River, S.P.	Casadepaga Mining Co.	2½
Solomon River, S.P.	Solomon Dredging Co.	3½†
Shovel Creek, S.P.	Charles Kimball	2½
Ophir Creek, S.P.	Wild Goose Mining & Trading Co.	3½†
Seward Peninsula	Star Dredging Co.	2½
Nome distr't	Saunders Dredging Co.	...
Nome (Osborn Cr'k)	Gold Beach Dredging Co.	5*
Nome (Osborn Cr'k)	Julien Gold Mining and Dredging Co.	2½
North Alaska	James Kelleher	2½
California (8):		
Folsom	Union Dredging Co.	9
Sacramento	Beaver Gold Dredging Co.	3½
Natoma	Natomas Consolidated of California (No. 9)	15
Natoma	Natomas Consolidated of California (No. 10)	15
Thermalito	Feather River Dredge	15
Oroville	Natomas Consolidated of California (Feather No. 3)	15
Oroville	Lawrence Gardella	5
Trinity county	Alta Bert Gold Dredging Co.	7½*
Canada (2):		
Dawson, Y.T.	Yukon Gold Co.	7½
Dawson, Y. T.	Dominion Goldfields, Ltd.	....
Idaho (2):		
Idaho City	Boston & Idaho Dredging Co.	14½
Salmon	Kirtley Creek Gold Dredging Co.	9
Montana (2):		
Cañon Ferry	Magpie Development Co.	5
Kennedy placers (Huson)	California Dredging Co.	5½
S. Dakota (1):		
Mystic	Castle Creek Dredging Co.	5†

*Reconstructed.
†Built previously, 1911 first operating season.

The accompanying table shows the places where dredges were installed in 1911, the number in each state, the bucket capacity in cubic yards and the names of the operating companies. During 1911 gold dredges were built and installed in North America by: The Bucyrus Co., South Milwaukee, Wis.; Union Iron Works Co., San Francisco, Calif.; Union Construction Co., San Francisco, Calif.; New York Engineering Co., New York; Straub Manufacturing Co., Oakland, Calif., and Yuba Construction Co., Marysville, Calif. It is interesting to note that of these concerns the Union Iron Works Co. is a combination of the Risdon and Union Iron Works; the Union Construction Co. is a new organization; the New York Engineering Co. again entered the list as a builder of dredges for use in North America.

DEVELOPMENT IN DREDGE CONSTRUCTION

As will be noted from the accompanying tabulation, practically all the dredges built for use in the United States, excepting Alaska, are of large bucket capacity. The modern 15-cu.ft. bucket dredges, such as erected in California in 1911, represent the highest type of gold-digging machine, and for ability to successfully handle maximum amounts of gravel under all conditions, are unequaled by any dredges built in this country or elsewhere. These are of the type of the Natoma No. 8 and Yuba No. 13, previously described in the JOURNAL[1].

NOTEWORTHY INSTALLATIONS

The 9-cu.ft. dredge, built for the Union Dredging Co., and installed at Folsom, Calif., deserves particular mention. This boat is designed with especially heavy machinery and will dig to a depth of 55 ft. It also has a heavy hull, larger by far than has heretofore been used for dredges of this capacity. The hull dimensions are: Length, 135 ft.; width, 46 ft. 6 in., and depth, 11 ft. 6 in. (The hull of the 15-cu.ft. Yuba No. 13 is 155 ft. long, 58 ft. 8 in. wide and 12 ft. 6 in. deep.) It is equipped with double gold-saving tables and hydraulic giants fed by a 10-in. centrifugal pump of 2000-gal. per min. capacity, driven by a 125-hp. motor. The revolving screen is 7 ft. in diameter and 37 ft. long. The digging motor is 200 hp., the starboard seven-drum winch is driven by a 30-hp. motor and the pumps by three motors of 100, 50 and 30 hp., respectively; the screen by a 40-hp. and the stacker by a 50-hp.

*Mining engineer, 526 Thirteenth St., Washington, D. C.

[1]"Dredge Installation during 1910," by John Tyssowski, "Eng. and Min. Journ.," Jan. 7, 1911; "Notes on the Construction of California Dredges," by John Tyssowski, "Eng. and Min. Journ., Oct. 15, 1910.

motor, making a total power equipment of 625 hp. (Yuba No. 13 has a power equipment of 720 hp.)

The dredge built for Lawrence Gardella and installed on the Downing tract at Oroville, Calif. in 1911 did not commence operation until January, 1912. It has a 5-cu.ft., close-connected bucket line and is electrically driven. This will probably be the last dredge installed in the Oroville field until a scheme for a closer gold saving is perfected.

A point of interest regarding the 5¾-cu.ft. dredge of the California Dredging Co., operating at Kennedy Placers, Huson, Mont., is the use of open-connected bucket chain and steam power. Water-tube boilers and compound-condensing engines are used.

Alaskan Dredges

In the Seward Peninsula region, the dredging industry still exhibits the same steady progress that was noted in 1910, as is witnessed by the installation of new dredges and a steady production of gold. The dredges for this region are generally equipped with open-connected bucket chains and gasoline or steam engines.

The ordinary dredging gravel in the Seward Peninsula region returns from 40 to 50c. per cu.yd. Operating costs, where no thawing has to be done and exclusive of amortization charges, are figured as low as 10 to 13c. per cu.yd. Frozen deposits not exceeding 10 to 12 ft. thick have been thawed at a cost not exceeding 11c. per cu.yd. Steam coal costs about $16.50 per ton and crude oil $2 per bbl. at the coast, but freight charges from the coast to the scene of operations are excessively high.

The 2½-cu.ft. dredge of the York Dredging Co., installed on Buck Creek, in the Port Clarence mining district, was designed for the recovery of placer tin, and is the first successful installation of this kind in the Western hemisphere. The dredge is operated by gasoline engines, and the hull is 30 ft. wide by 60 ft. long and 5 ft. deep.

The dredge built for the Julien Gold Mining & Dredging Co., of Osborn Creek, near Nome, is fitted with gasoline engines, revolving screen and belt-conveyor tailings stacker. This latter feature is quite a departure in the design of boats for this region, the use of sluice boxes instead of screens and stackers being the common practice.

A dispatch announces the completion of the Arica-La Paz railroad, on Mar. 5; this line, connecting Chili and Bolivia, is about 270 miles in length, and gives Bolivia a much shorter route to the Pacific. Beginning at Arica, the road passes over a desert country for 50 or 60 miles, crosses the Andes and then continues for about 200 miles in the high tablelands of Bolivia.

The Messina (Transvaal) Development Co.

Announcement was recently made that Camp Bird, Ltd., had been given an opportunity to acquire an interest in the Messina (Transvaal) Development Co., Ltd., and has agreed to guarantee the interest for five years on an issue of £250,000, 6% debenture stock.

The Messina company has a capital of £250,000 divided into 1,000,000 shares of 5s. each, of which 661,804 are issued. The new debenture stock will be issued at 95% and subscribers will receive an option certificate entitling the holder to subscribe at any time before Mar. 1, 1915, for one share in the capital of the Messina company at 22s. 6d. (the present market price, according to the circular) in respect of each £2 of debenture stock allotted. The shares under said option to rank *pari passu* with the ordinary shares for all dividends declared after date such shares are paid for. The profits of the Messina company up to £35,000 will be set aside beginning July 1, 1916, as a sinking fund for the redemption of the debenture at 105%. The company reserves the right to redeem debenture stock at any time at 105, after giving three months' notice.

The object of this stock issue is to furnish the Messina company with additional working capital with which to further develop and equip the mine, enlarge the mill to a capacity of 120,000 tons per annum, and to establish smelting works, which have not been built on account of lack of transportation facilities. Arrangements have been made with the South African government by which the railroad now being built will, it is expected, reach the mine by the end of 1912.

The Messina copper mine is situated on the government farm, Berkenrode, in the Zoutpansberg district of northern Transvaal. The other properties of the company are in the same district and adjacent to Berkenrode. The Messina company has acquired 200 coal claims, each 150x400 ft., about 15 miles southwest of Messina. The following data are taken from the report for the year ended June 30, 1911, of the company's consulting engineer, J. M. Calderwood:

There are four veins being worked in the mine. The total ore mined and concentrates produced for shipment since the commencement of operations to June 30, 1911, were respectively 65,788 and 9699 tons. The concentrates contained 53.1% copper. The ore in sight and probable ore above the eighth level is estimated at 430,000 tons from which a profit of £600,000 is expected, estimating copper at $55 per ton.

A shaft has been sunk to a depth of 818 ft. and the lowest level has been opened at a depth of 814 ft. The ore in the station at the eighth level is 27 ft. wide and assays 17% copper. From the bottom of the shaft up to the 780-ft. level the ore is bornite and chalcopyrite. The average assay value for the last 54 ft. sunk was 22% copper for an average width of six feet. Chalcocite was found in the shaft where it passed through the north vein at a depth of 660 ft. This ore assayed 36.9% copper at one place and 54.3% at another over a width of 24 in. exposed.

The total amount of development work done during the fiscal year 1911 was 2005 ft., fully half of which was done along the lode. About 650 ft. of the development work has been sampled, giving an average of 9.6% copper over a width of five feet. The total of all development work throughout the mine, including shafts, amounts to 19,533 ft. The blocked-out ore reserve on June 30, 1911, was 102,000 tons averaging 10% copper, and it is expected that it will be possible to greatly increase the production of ore of this average grade.

The total costs for the year ended June 30, 1911, during which time 18,573 tons of ore were mined and milled, were: Mining $3.80; dump ore 30c.; milling $1.56; development redemption $1.20; Johannesburg charges $1.02; total $7.88. The mill power is now furnished by a gas engine supplied with gas made in a suction producer from locally made charcoal, but two seams of coal, one 3 ft., the other 5 ft. wide, have been found on the company's coal land. These are expected eventually to produce fuel for power and smelting.

British Tin Ore Imports

The following table shows the imports of tin ore into Great Britain for the years 1910 and 1911, as reported by the *Mining Journal*, Jan. 13, 1912:

BRITISH TIN-ORE IMPORTS

Imported from	1911 Tons	1910 Tons
Africa—		
Cape of Good Hope	14	73
Natal	75	1
Nigeria	....	457
Portuguese E. Africa	10	79
Southern Nigeria	1,378	433
Transvaal	2,199	2,936
Swazieland	1,119	328
Rhodesia	....	1
America—		
Canada	7	4
United States	228	72
Mexico	14	....
Argentine Republic	19	12
Bolivia	16,114	15,693
Chile	4,450	3,527
Peru	847	580
Asia—		
British India	....	9
Japan	55	110
Straits Settlements	6	10
Australasia—		
Tasmania	....	1
Victoria	....	15
New South Wales	14	....
Europe—		
Austria-Hungary	5	7
Belgium	54	24
Denmark	....	2
France	852	822
Germany	779	325
Italy	66	128
Netherlands	105	108
Portugal	31	16
Russia	177	171
Spain	154	165
Sweden	7	....
Totals	28,779	26,109

The Practice in Blende Roasting

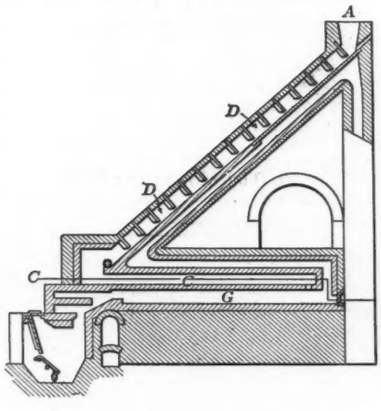
By E. Schütz

An historical review of the development of the methods of blende roasting with descriptions of some of the furnaces employed in Europe and America.

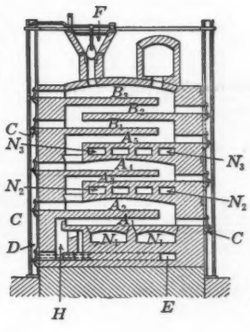
Note—Abstracted by O. H. Hahn from an article in "Metallurgie," Oct. 22, 1911.

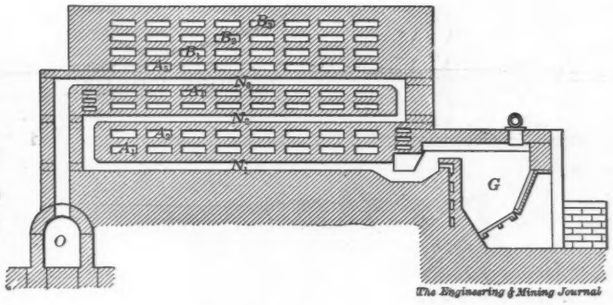
The beginning of the rational roasting of blende dates back to the middle of the last century, when the problem of utilizing the SO_2 evolved in the roasting process sprang up. Prior to 1855 the blende was roasted altogether in reverberatories of the Freiberg pattern and the sulphurous acid allowed to escape along with the combustion products into the atmosphere.

Attempts had not been wanting to extract the SO_2 from this mixture, but without notable success, and it became necessary to change the form of the furnace in order to keep the combustion products and roaster gases separate. Before going into a discussion of the various forms of furnaces devised for the roasting of blende, I will briefly touch on the points of difficulty in the process which are due to the chemical behavior of the blende and to the high degree of desulphurization required in the finished product. To illustrate the latter point, a chemical factory which roasted blende as a transitory material for a smeltery had to stand a deduction from its roasting charges if the product delivered contained only 0.1% more sulphur than the limit stipulated by contract.



HASENCLEVER-HELBIG ROASTER





EICHHORN-LIEBIG FURNACE

DEAD ROAST IN REVERBERATORY EASY

As to the chemical behavior of blende in roasting, there was no difficulty in roasting it dead in the reverberatory. After the introduction of muffle furnaces, when the roast gases had to contain at least 5 per cent. by volume of SO_2 in order to make them available for the manufacture of sulphuric acid, the skill of the workmen was taxed to the highest degree in furnishing an unobjectionable product. The process of roasting blende is, according to the equation $ZnS + 3O = ZnO + SO_2$, an exothermic one (giving off heat), for a simple thermochemical calculation shows in the above decomposition an excess of 115.5 cal. (458.3 B.t.u.) But, as the blendes contain at the most 30% S, this quantity of heat does not suffice to carry the roasting operation to a successful issue without external firing. For this reason a steady heat has to be maintained in the fire place or places connected with the furnace.

Furthermore, the zinc sulphate formed in roasting has to be split into its components; otherwise the sulphur content of the product would remain too high. The following results have been recorded on the temperatures at which the zinc salt is formed, and at which its decomposition by heat takes place. L. and P. Wöhler and Plüddemann have found that in the oxidizing roasting of blende up to about 800° C., $ZnSO_4$ is formed and that its dissociation temperature is at nearly 900° at the ordinary pressure of the atmosphere. H. O. Hofman, *per contra*, asserts that decomposition of the anhydric sulphate is complete beyond 770° C., and that basic salt is formed in small quantities only.

ZINC SULPHATE DECOMPOSITION REVERSIBLE BELOW 900° C.

Doeltz and Graumann have also found that from 700° C. on, a rapid, although incomplete decomposition of $ZnSO_4$ takes place. They call attention to the fact that the reaction $ZnSO_4 = ZnO + SO_3$ may be assumed as still reversible at 900° C., unless the SO_3 gas can be quickly removed, or if, on the other hand, the temperature is lowered in the furnace; for example, by opening the working doors. It will be seen from these statements that in a blende-roasting furnace a temperature up to 900° C. must prevail if all the sulphate is to be decomposed and roasting is to be carried on successfully. Furthermore, these figures accentuate the importance of correct and judicious firing.

Last, but not least, a good roast depends a great deal upon the quality and willingness of the workmen. The work of constant rabbling is hard, but necessary; neglect on the part of one man may spoil the output of 24 hours' labor. This refers particularly to the Rhenania furnace. It is especially desirable that a green charge, on being dumped into the furnace, should be vigorously rabbled at once, in order to oxidize as much as possible of the sulphur in the blende on the topmost story, since the heat of formation of the sulphurous acid is added[1] to the heat artificially produced and the production of an excessive quantity of zinc sulphate is avoided.

SULPHUR FIRST UTILIZED IN 1874

The first furnace constructed with a view of utilizing at least part of the sulphur in roasting blende is the one of Hasenclever and Helbig, which came out in 1874, of which a longitudinal vertical section is given. It consists of a reverberatory furnace *G*, above which there is a muffle *C*. The bottom of this muffle is, at the same time, the roof of the reverberatory, and is heated in that way. The fire gases play around the muffle and finally, in their upward course, heat the most singular part of this furnace construction,

[1]This is denied by the constructing engineer of the Stolberger Aktiengesellschaft in "Metallurgie," Nov. 22, 1911, p. 714. He claims that this heat is carried off by the roast gases.

consisting of an inclined plane slanting at an angle of 43°. At the top of this incline the ore is charged through a hopper *A* and, to keep it from sliding down too fast, the partition walls or baffles *D* are inserted. In the muffle as much as possible of the sulphur should be removed; the last remnants of it are then left to be expelled in the reverberatory mingled with the fire gases. The SO_2 here evolved, amounting to more than one-third of the original sulphur, is lost entirely; hence only about 60% are available for SO_3 manufacture.

The priority in utilizing the whole of the sulphur of the blende is due to M. Liebig, who, in common with Dr. Eichhorn, obtained German pat. No. 21032 in 1882, on what is known as the Eichhorn-Liebig furnace. It is the regular type of a muffle furnace, designed to keep the roast gases separate from the fire gases. Accompanying illustrations represent longitudinal and transverse sections of this furnace. A_1, A_2, A_3, A_4 and A_5 are hollow floors or hearths, the hollow parts serving as heating chambers N_1, N_2, N_3, through which the hot gases circulate, while the three top floors B_1, B_2, B_3, are solid blocks of special firebrick. Access to the several floors is had by the doors *C*. The heating of the furnace is effected by the gas producer *G;* the hot gases after passing through N_1, N_2, N_3 make their exit by the flue *O*. The air for oxidizing is admitted at *D* and is heated by the hot air in chamber N_1, while passing through *E*. The blende drops through the hopper *F* on B_2, and is, after ignition, shifted further until it finally arrives at *H* in a finished condition. A furnace of that kind puts through four tons in 24 hours, with a consumption of 0.8 ton of coal and, with blendes free from lime, the sulphur content will come down to 0.1% S. In the case of calcareous vein matter, 2½% of the S are retained in the form of gypsum.

Description of the Rhenania Furnace

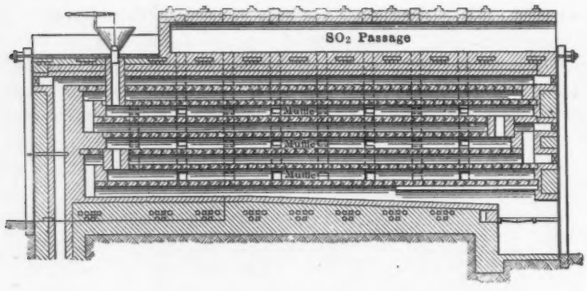
At the Rhenania Chemical Works, Aix-la-Chapelle, Prussia, the above furnace was remodeled, and to distinguish the new style from the old one, has been called the Rhenania furnace. The most troublesome parts in the Eichhorn-Liebig furnace had been the blocks *B*, which were replaced by arch stones, in order to make them more durable. The charges drawn were also too small in bulk; to make them larger it was necessary to enlarge the dimensions of the furnace all around. The cuts represent longitudinal and transverse sections of the Rhenania furnace. It consists of three muffles arranged one above the other, around which the fire gases circulate. If the blendes are rich in sulphur the hot fire gases are allowed to circulate around the lowermost muffle only, and are then conducted directly to the chimney. The engravings show the furnace as provided with a grate firebox, but the use of producer gas would be more appropriate. It is of importance that the finely ground ore should be fed to the furnace thoroughly dried, to insure its immediate ignition upon entering at the top.

Rhenania Roasting Takes 20% of Fuel

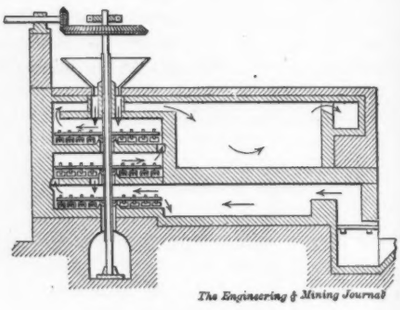
The labor in the furnace consists in stirring or rabbling the ore and shifting it from one hearth to the next lower one until it at last arrives at the draw hole; in this way the sulphur is at first rapidly, then gradually oxidized to SO_2. The air enters through the working doors and the gases leave the furnace proper through flues in the back wall, opposite these doors and are collected in the main flue leading to the lead chamber. A Rhenania furnace has, like its predecessor, a capacity of 4000 kg. of roasted ore in 24 hours, and consumes 20% of fuel.

The weight of each charge drawn varies between 450 and 500 kg. In large works four of these furnaces are generally united in one block, and attended to by a special fireman on a 12-hour shift. After this type of furnace had been brought into successful operation and run for several years, the management, to make itself independent of manual labor, saw fit to construct a mechanical roasting furnace, which was patented in 1891. The rabbling and moving of the ore was here performed by a traveling belt with scraper attachment. But the scheme did not work satisfactorily and was given up.

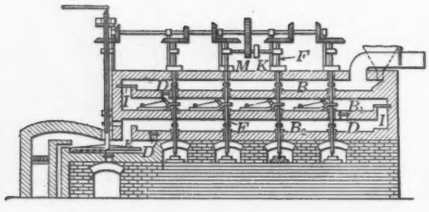
In this connection it may be mentioned that at about the same time two other mechanical furnaces made their appearance, one patented by Haas and another patented by the Société Vieille Montagne. The former resembled the MacDougal furnace in several particulars, notably in having mechanical scrapers which turned over the ore and moved it successively from one hearth to the two lower ones and finally landed it on the floor of the reverberatory, where the roasting operation was brought to a finish. This fur-



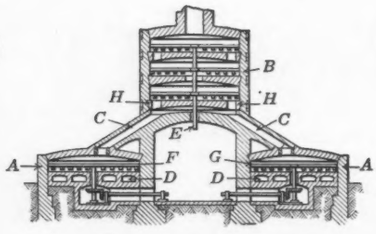
Rhenania Furnace



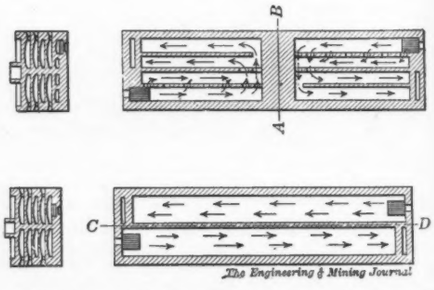
Vieille Montagne Type



Merton Furnace



Zelewski Furnace



Peterson and Rhenania Types Compared

nace was operated for some time at Oberhausen, Rhenish Prussia, but was finally abandoned.

The furnace of the Société Vieille Montagne is sketched in the accompanying illustration. The fatal part of this furnace, as of those of Meyer, Wedge, Heberlein-Hommel, Hommel and others, is the large amount of ironwork exposed to a high degree of heat and the corrosive action of the roast gases.

Another drawback of all the mechanical furnaces is that the ore has to be taken as it comes out through the discharge. If it should contain too much sulphur it is unfit for the succeeding reduction process and has to be reroasted in admixture with raw ore. From the Rhenania furnace no charge is drawn until a sample has been tested for sulphur in the laboratory. This is done by boiling the sample with HCl in a test tube and holding a strip of paper impregnated with acetate of lead over it. If a black spot appears on the paper, the charge must be further rabbled. If there is only a brownish tinge on the paper, the charge may be considered as finished.

By reason of their shortcomings, these furnaces had to give way again to the Rhenania furnace and its variations. The Société Vieille Montagne for one has returned to the muffle furnace of the Rhenania.

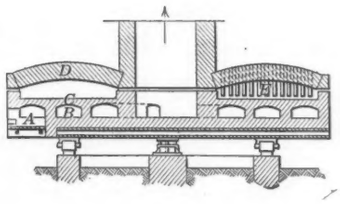
Not Enough Flexibility in Mechanical Furnace

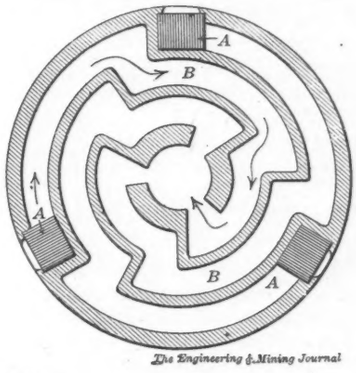
The Merton furnace is strongly recommended by Kroupka in the *Oest. Zeit. für Berg- und Hüttenwesen*, 1904, p. 187, and is said to be in operation at a number of Belgian works. From the drawing it appears that the furnace consists of three stories of rectangular reverberatory hearths B, B_1, B_2 and a finishing hearth E, on all of which the ore is stirred by plows fastened to upright shafts made to revolve by proper gearing. The ore runs continuously through the discharge holes D from the top downward. The reverberatory furnace is not conducive to saving all the roast gases; hence the Merton Furnace Co. advertises that it also sells its furnaces muffled.

Another furnace said to be used by some Belgian companies is the one patented by R. von Zelewski. It consists of the furnace proper B and two finishing roasters A connected with B through flues C. The ore is rabbled and shifted by the gears E, F, G, each of which may be run at a different speed. By the setting of the dampers H the supply of the finishing roasters is regulated.

The Petersen Furnace

Another illustration represents a furnace patented by H. Petersen, who does not think much of the mechanical furnaces so far constructed for blende roasting. This furnace is an altered type of the Rhenania furnace, as a comparison will show. Its advantages are claimed to be: a longer life, a smaller consumption of coal, a better roast without clotting and a larger tonnage. The chief difference of the Petersen from the Rhenania furnace is that its center line $A\,B$ passes through the short axis while in the Rhenania it cuts through the long axis CD. The advantage of this arrangement is that in repairing or tearing down one side of the furnace the other one is not affected. Another advantage of the Petersen construction is based upon the possibility of regulating both compartments of the furnace side connected with a fire place. The fire flues are so arranged that the lowest hearth of the first and then that of the second compartment are heated. Thereafter the fire gases are divided in rising and pass simultaneously through between the lowest and second-lowest muffles of both compartments; at the end they drop into the flue leading to the chimney. The division of the gases for both sides of the furnace is effected by dampers in such a way that either both furnace sides receive an equal volume of hot gases, or the one more, the other less. The dampers are placed at the end of the fire flues where they enter the main flue.





Stolberg Furnace

The Stolberg Furnace

The Stolberg furnace is patented by the Aktiengesellschaft für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westphalen. The figures show a rotatable hearth, underneath it the fire places A and the fire flues B. Above C there are the arches D with the rabbles E. By this arrangement the hearth may be heated uniformly in all its parts and conformable to various purposes. But the furnace does not appear to be designed with a view to make use of the heat of reaction[2] emitted in the oxidation of the sulphur. According to the patent specifications the fire places revolve with the hearth; they may be fixed solidly to the hearth or may be made removable so that the number of fire places may be increased and a defective one can be easily and conveniently removed. The advantages of this furnace are, therefore, only in the manner of firing[3].

The Matthiessen-Hegeler Furnace

The Matthiessen-Hegeler furnace, a muffle furnace provided with mechanical stirring apparatus for roasting blende, has been in successful operation in America since the '90s of the last century, at La Salle, Ill. It consists of a heavy rectangular block 24 m. in length by 5 m. wide by 6 m. high and is divided into two single furnaces by a partition running lengthways through the middle. Each furnace side has seven muffles, one above the other, for roasting blende and two muffles for the fire gases, The muffles have a length of 23.5 m. in the clear and a width of 1.85 m. For the blende muffles there is, therefore, a total roasting area of 43.5×7 m. $= 304$ sq.m. and a length of 164.5 m. to be traveled by the blende.

This furnace is much more durable than a Rhenania furnace, its life being stated to be about five years. The greater durability is accounted for by the temperatures being lower in the Matthiessen-Hegeler furnace than in a furnace manipulated by hand. The highest temperature in the blende muffle is 800° C. while in a hand furnace temperatures of 900 to 950° are required. In the Matthiessen-Hegeler furnace are roasted high-grade blendes with 58% Zn and 30% sulphur reduced to 2-mm. size. Its output per 24 hours is 40 tons of roasted blende retaining less than 1% S. There is no clotting in roasting; any slag that may incidentally form sticks to the sides of the furnace and is removed from time to time through holes provided for that purpose. The almost perfect desulphurization of the ore is principally due to two facts: (1) The way which the blende has to travel is seven times as long as in a Rhenania furnace worked by hand.

[2]See note 1.

[3]Ibidem, the same authority says that a one-story roasting furnace can only give good results by having several fireboxes, and it is then ready to work any kind of blende, while the multi-story ones are only adapted to one particular ore. The furnace in question is in operation at the Münsterbush zinc works, and gives good results, although the warping of iron parts gives occasional trouble.

(2) The rabbling of the blende takes place much more frequently than in a hand furnace.

While in the Rhenania furnace the blende is only rabbled every six hours, it is done by this furnace every 1¼ hours in a much more vigorous manner, that is to say, five times as often. The whole procedure takes about 72 hours. A further advantage of this furnace, which has been alluded to already, is that the roasting operation takes place at a lower temperature, owing to the vigorous working whereby volatilization of metallic zinc from the blende is prevented, which begins at a temperature of 900°. The manipulation of the furnace is simple and easily learned by any workman. The crew required per 24 hours is 10 men. Coal consumption, varying according to quality, is between 25 and 30% of the roasted blende; consumption of power, 10 hp. at the most. Repairs are slight, amounting to, say, 4000 marks per year. Accordingly, the cost of roasting per 40 tons roasted blende in 24 hours, without counting general expense and amortization of plant, is as follows:

	Marks
Wages of 10 men at 5 marks.....	50
Coal, 40 × 0.3 = 12 tons at 8 marks..	96
Power, 10 × 0.24 at 4 marks.....	10
Repairs, 4000 ÷ 365.....	12
Total	168

Hence one ton costs 4.20 marks to roast. (1 mark = 23.8c.)

Matthiessen Furnace Expensive to Install

These furnaces are also adapted for ores with lime and magnesia gangue. Although the Matthiessen-Hegeler furnace has won its way in the United States, owing to the economies gained by it, operators in Europe have been chary of adopting it for several reasons. In the first place its great cost is an objectionable feature. Considering that an accident may occur to a single furnace at any time, it would be necessary to have a second one in reserve. This would involve an outlay of twice 120,000 marks, an amount of money which a small reduction works could ill afford to keep locked up. Secondly, an output of 40 tons of ore a day would necessitate the keeping of a large supply in stock to guard against emergencies. The failures of the Haas, the Vieille Montagne and other furnaces may also have contributed their share in making people cautious. Thus far only one instance is known of the introduction of the Matthiessen-Hegeler furnace in Europe, viz., at the works of a wealthy company in Upper Silesia.

Use of Steam in Roasting

There is a possibility that the application of steam would be of service in accelerating the roasting process, but not through injecting it into the furnace, which has been tried without success. Thomas, in *Metallurgie*, 1910, parts 19 and 20, proposes to produce steam through the combustion of hydrogenous fuel, which is intimately mixed with the zinc ore. For this purpose he briquettes his ore with tar, pitch or other hydrocarbon material. The steam evolved is then in intimate contact with the blende, and contributes materially to its oxidation. The process goes on at a lower temperature (700 to 820° at the most) and in a shorter time than the present mode of roasting. But there is another point to it which the application of mechanical roasting furnaces permits, and that is the manner of automatic removal of the roasted from the unroasted material. The particles of ore in the briquettes are kept together until they are completely roasted. This transformation naturally takes place first on the surface of the briquettes, so that in slowly moving these bodies toward each other in roasting trommels or on movable grates, the well roasted stuff crumbles off from the briquettes and drops through openings in the bottoms or walls of the roasting appliances into a cooling chamber, in which the last remnants of still existing sulphates are finally decomposed by the hot gases from a fire place.

Protection of Pipe from Corrosion

Corrosive conditions are often so severe in pipe lines that unprotected iron and steel will not last long. Since electricity has become widely used, the life of pipe underground is still further jeopardized and the necessity for adequate protection has become more apparent. A special study of the manufacture of slow-corroding steel for pipe has been made by the National Tube Co., of Pittsburgh, Penn. and a soft steel has been developed having an exceptionally high degree of uniformity. This has been further improved by a patented process of hot forging, known as spellerizing, which is applied to the metal in the course of manufacture by which the surface portion is rendered more uniformly dense and less liable to become pitted. Where no protective coating can be applied this steel will give good service.

However, it is the nature of iron to become oxidized and go into solution in the combined presence of water and oxygen, the reaction being accelerated by the presence of free acids and salts in solution, especially where stray electric currents leave the pipe. Against the inroads of such reactions there is no satisfactory remedy except that of keeping moisture away from the metal. To protect pipe from moisture the company has developed the "National" coating and is at present in a position to apply it to pipe ranging from 3 to 18½ in. diameter.

In applying "National" coating, the pipe is first cleaned and dried, and while still at a temperature above the boiling point of water, is dipped into a hot bath of a special bituminous compound and kept there until the pipe has the same temperature as the bath. On removal from the bath the pipe is allowed to drain vertically and cool, leaving the pipe covered inside and outside with an elastic compound, the consistency of which can readily be adapted to the temperature conditions under which the pipe is to be used. By a second operation this enamel-like surface is wrapped with a strip of fabric that has been thoroughly saturated with the hot compound. Immediately after being saturated with the compound the fabric is wound spirally over the surface of the pipe, overlapping about one inch on each turn, covering and firmly adhering to the body coat. Two or three thicknesses may be applied in this way where desired to meet special conditions. The average thickness of ordinary paints or bituminous dips rarely exceeds $^1/_{100}$ in., but in the case of one-ply "National" coating the thickness of the protection amounts to about 3/64 in. The exclusion of moisture is the main purpose kept in view in applying this coating to pipe. So long as moisture is prevented from reaching the metal, no corrosion or electrolysis is possible.

For providing the joints of this pipe with a similar coating of compound and fabric, extra materials are furnished with each shipment of pipe, sufficient for covering all the joints in the line. When pipe covered with this coating is ordered, the conditions under which the pipe is to be used, character of soil, drainage, etc., and the range of temperature which will probably be found at the time of the year when the pipe is to be laid, should be specified.

A New Tin Discovery

In view of the recent high prices of tin and the discouraging reports of the tin industry of the Federated Malay States, the report of a new tin field in Johore (*Min. & Eng. Review*, Queensland, Nov. 5, 1911) is encouraging. The field is being exploited by Singapore tin men, and is situated at the head of the Lingtu River, a branch of the Johore River, about 45 miles from Singapore. In the future it appears that water transportation will be possible right through to the field, but the waterway is not entirely cleared through the jungle, so that the present plan for working it is to take in overland a suction dredge, which has been designed so that no separate part will weigh more than 400 lb. The machinery at present contracted for is being supplied by Thompson & Co., of Castelmaine, Victoria.

The Mineral Production of Canada

By John McLeish*

The production in 1911 was slightly less than 1910, on account of the protracted strike of the coal miners in Alberta and British Columbia.

The mining industry during the years 1909 and 1910 showed such substantial progress and large increase in output that it is not surprising a slight falling off should be shown in 1911, particularly when it is remembered that the long continued strike of coal miners in Alberta and the Crows Nest district of British Columbia not only seriously reduced the coal output, but also, because of the closing down of the Granby smeltery on account of the coke shortage, caused a lower production of copper, silver and gold than would have otherwise been obtained.

The preliminary statistics herewith published, based upon direct returns from mine and smeltery operators but subject to final revision, show the total value of the production in 1911 to have been $102,291,686, a falling off of $4,531,937 or 4% when compared with the production in 1910. The returns for 1911 are given in the accompanying table.

The subdivision of the mineral production in 1910 and 1911 by provinces was approximately as in table II.

Of the total production in 1911 a value of $46,197,428 or 45 per cent. is credited to metals and $56,094,258 to nonmetallic products. Practically all of the metals with the exception of pig iron show a falling off in production in so far as value is concerned. In the case of copper, however, there was an increased output of the metal although the average price per pound was slightly lower than in 1910. The increase in pig-iron production was quite considerable although this is chiefly attributable to imported ore. Among the nonmetallic products increases are shown in the production of arsenic, asbestos, feldspar, graphite, natural gas, pyrites, salt and in nearly all of the structural materials, including cement, clay products, stone, lime, etc. Outside of the metallic products, the principal decreases are in coal and petroleum; the falling off in value of coal production alone being practically equivalent to the total net decrease for the year.

The reduction of 4.2% in 1911, as compared with 1910, is the first shown since 1905. The total last year was about 10 times that of 1886, the first year that reports were made in the present form.

Smeltery Production

General statistics of smeltery production have been collected by this Branch since 1908. Complete returns have been received for the year 1911 with the exception of one or two plants recently established for the treatment of Ontario silver-cobalt ores. It should also be explained that the accompanying statistics include the treatment of a small quantity of imported ores in the British Columbia smelteries.

The total quantity of ores treated in 1911 was 2,192,727 tons as compared with 2,683,714 tons treated in 1910. These ores are classed as follows: Nickel-copper, 610,834 tons; silver-cobalt-nickel-arsenic, 8504; lead and other ores treated in lead furnaces, 55,408; copper-gold-silver, 1,517,981 tons.

The closing down of the Granby smeltery, due to coke shortage, was the principal cause of a falling off in the copper-gold ores treated. The products obtained in Canada from the treatment of these ores include: Refined lead produced at Trail, B. C., and fine gold, fine silver, copper sulphate and antimony produced from the residues of the lead refinery; silver bullion, white arsenic, nickel oxide and cobalt oxide produced in Ontario from the Cobalt District ores. In addition to these refined products, blister copper, copper matte and nickel-copper matte are produced and exported for refining outside of Canada.

The aggregate results of these smelting and refining operations for the years 1910 and 1911 are summarized in table III.

Smeltery products shipped outside of Canada for refining were: Blister copper, carrying gold and silver values, 10,710 tons in 1911, as compared with 13,918 tons in 1910; copper matte carrying gold and silver values, 11,320 tons in 1911, as against 11,519 tons in 1910; bessemer nickel-copper matte, carrying small gold and silver values as well as metals of the platinum group, 32,607 tons in 1911, as compared with 35,033 tons in the previous year.

Gold

The gold production in 1911 is estimated as approximately $9,762,096 which, compared with that of 1910, shows a falling off of $443,739. The Yukon placer production in 1911 is estimated at $4,580,000 as against $4,550,000 in 1910, the total exports on which royalty was paid during the year, according to the records of the Interior Department, being 277,431 oz. in 1911 and 275,473 oz. in 1910. The British Columbia production in 1911 was $4,989,524, of which the placer production, as estimated by the Provincial Mineralogist, was $468,000, smeltery recoveries and bullion obtained from milling ores being valued at $4,521,524. The production in Nova Scotia is estimated at $142,000, all from milling ores. In Quebec there was a small recovery from alluvial workings and a small content in the pyrite ores shipped, the total value of production being $12,443. Returns so far received from Ontario show a production of $37,929.

The exports of gold-bearing dust, nuggets, gold in ore, etc., in 1911 were valued at $7,493,523. Gold was imported in bars, blocks, ingots, etc., to the value of $924,233 during the year.

Note—Abstract of annual report.

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MINERAL PRODUCTION OF CANADA IN 1911

(Subject to Revision)

Product	Quantity	Value
Metallic		
Copper.....Lb.	55,848,665	$6,911,831
Gold.....	.....	9,762,096
Pig iron from Canadian ore.....Tons	42,186	613,404
Iron ore sold for export..... "	39,162	86,812
Lead.....Lb.	23,525,050	818,672
Nickel..... "	34,098,744	10,229,623
Silver.....Oz.	32,740,748	17,452,128
Cobalt and nickel oxides	.....	221,790
Zinc ore.....	2,590	101,072
Total metallic.....	.....	$46,197,428
Nonmetallic		
Actinolite.....Tons	67	736
Arsenic, white.... "	2,097	76,237
Asbestos..... "	100,893	2,922,062
Asbestic..... "	26,021	21,045
Chromite..... "	27	351
Coal..... "	11,291,553	26,378,477
Corundum..... "	1,472	161,873
Feldspar..... "	17,718	51,924
Fluorspar..... "	34	238
Graphite..... "	1,269	69.576
Grindstones..... "	5,312	49,942
Gypsum..... "	505,457	978,863
Manganese..... "	5½	300
Magnesite..... "	991	5,531
Mica..... "	.....	119,863
Mineral pigments—		
Barytes..... "	50	400
Ochers..... "	3,622	28,333
Mineral water.....	.....	223,758
Natural gas.....	.....	1,820,923
Peat.....Tons	1,463	3,817
Petroleum.....Bbl.	291,092	357,073
Phosphate.....Tons	558	4,928
Pyrites..... "	82,666	365,820
Quartz..... "	60,526	83,865
Salt..... "	91,582	443,004
Talc..... "	7,300	22,100
Tripolite..... "	20	122
Total non-metallic...	.....	$34,191,161
Structural Materials and Clay Products		
Cement, portland..Bbl.	5,635,950	7,571,299
Clay products:		
Brick.....	.....	6,521,558
Sewerpipe.....	.....	799,756
Fireclay, pottery, &c.	.....	996,395
Lime.....Bu.	7,227,310	1,493,119
Sand and gravel (exports).....Tons	573,494	408,110
Sand-lime brick.....	.....	424,241
Slate.....Sq.	1,833	8,248
Stone:		
Granite.....	.....	880,309
Limestone.....	.....	2,282,146
Marble.....	.....	140,903
Sandstone.....	.....	377,013
Total structural materials and clay products.....	.....	$21,903,097
Total value, 1911....	.....	$102,291,686

SILVER

The silver production of Canada, which has been rapidly increasing during the last few years, will show but little change in 1911.

Returns so far received indicate a falling off of about 128,516 oz. The total production of the year is estimated at 32,740,748 oz. valued at $17,452,128, of which 30,761,690 oz. were from Ontario, 1,910,323 from British Columbia, 50,300 from the Yukon and 18,435 oz. from Quebec.

The production in Ontario was slightly greater than that of the previous year and in British Columbia a falling off of nearly half a million ounces is shown. For British Columbia the figures represent the recovery as silver bullion or silver contained in smelter products, while for Ontario the figures represent the total silver content of ore and concentrates shipped less 5% allowed for smeltery losses, together with bullion shipments.

The total shipments of ore and concentrates from the Cobalt District and adjacent mines were about 16,234 tons, containing approximately 23,817,198 oz., in addition to which 3,334,052 oz. were shipped as bullion. The average silver content of ore and concentrates shipped was thus about 1744 oz. per ton as compared with an average of 867 oz. in 1910 and 840 oz. in 1909. The 1911 shipments were chiefly high-grade ore and concentrates.

The exports of silver in ore, etc., as reported by the Customs Department were 31,216,725 oz. There was also an importation of silver in bars, blocks, sheets, etc., valued at $847,645 in all.

COPPER

There is practically no production of refined copper in Canada, and the production is represented by the copper contents of smelter products, matte and blister copper, produced, together with the amount of copper contained in ores exported estimated as recoverable.

The total production on this basis in 1911 was 55,848,665 lb. as compared with 55,692,239 lb. in 1910. The total copper contents of ores shipped in 1911 were approximately 67,282,590 lb., being 3,123,189 lb. from Quebec, 21,402,221 lb. from Ontario and 42,757,180 lb. from British Columbia. This record is of special interest as illustrating the distinction between ore contents and smelter recoveries.

Of the production or smelter recovery in 1911, Quebec is credited with 2,436,190 lb. This is altogether from pyrite ores, which are mined primarily for their sulphur contents. Ontario's production in 1911 was 17,932,263 lb., all being from the nickel-copper ores of the Sudbury district.

The production in British Columbia notwithstanding the failure of the domestic coke supply due to strikes in the coal mines of the Crows Nest Pass district and the consequent shutting down of the Granby smeltery for nearly five months, shows a slight increase, being estimated at 35,480,212 lb. in 1911 as against 35,270,006 lb. in 1910. The British Columbia Copper Co. operated with larger output, using imported coke, and production from Coast mines, particularly the Britannia and Marble Bay, was specially active. The increased production from these mines more than balanced the falling off at Granby.

The total exports of copper contained in ore, matte and blister, etc., according to Customs Department returns, were 55,287,710 lb., valued at $5,467,725, which agrees fairly closely with the record of production. The total imports of copper in 1911 were valued at $4,936,459, and included 35,155,550 lb. of crude and manufactured copper; copper sulphate, 2,191,899 lb., and other copper manufactures, valued at $215,588 in all.

LEAD

The total production of pig and manufactured lead in 1911 was 23,525,050 lb. There was also a small production of lead concentrate from Calumet Island, Que., the shipments being about 45 tons. The total showed a considerable falling off in 1911. The decrease is probably chiefly due to the diminished tonnage from the St. Eugene mine, in East Kootenay and the idleness of some of the more important mines of the Slocan, following the destruction of the Kaslo & Slocan Ry. by forest fires in 1910. The exports of lead in ore in 1911 are reported as 32 tons, and of pig lead only 36 tons.

The total value of the imports of lead and lead products in 1911 was $1,049,276, including 13,135 tons in the form of pig lead, bars, sheets, etc., valued at $706,020; manufactures of lead, valued at $108,012; litharge and lead pigments having an equivalent lead content of approximately 2395 tons, valued at $235,244. The total value of the imports of lead products in 1910 was $833,743, and with the exception of manufactures, valued at $107,688, represented an equivalent lead content of 10,544 tons. The total bounty paid on lead produced was $219,558 for the year.

NICKEL

The mining and smelting of nickel-copper ores in the Sudbury district of Ontario was carried on actively throughout the year, and although the production was slightly less than in 1910, it was still very much larger than in any previous year. Active operations were, as usual, carried on by the Mond Nickel Co., at Victoria Mines, and the Canadian Copper Co., at Copper Cliff, Creighton, Crean Hill, etc., while the Dominion Nickel Co. continued to develop its property at Norman Station.

TABLE II. VALUE OF PRODUCTION BY PROVINCES

Province	1910 Value	1910 Per Cent. of Total	1911 Value	1911 Per Cent.
Nova Scotia	$14,195,730	13.29	$15,354,928	15.01
New Brunswick	581,942	0.54	611,597	0.60
Quebec	8,270,136	7.74	9,087,698	8.88
Ontario	43,538,078	40.76	42,672,904	41.72
Manitoba	1,500,359	1.40	1,684,677	1.65
Saskatchewan	498,122	0.47	618,379	0.60
Alberta	8,996,210	8.42	6,404,110	6.26
British Columbia	24,478,752	22.92	21,237,801	20.76
North West Territories	4,764,474	4.46	4,619,592	4.52
Dominion	$106,823,623	100.00	$102,291,686	100.00

TABLE III. SMELTERY AND REFINERY PRODUCTION IN 1910 AND 1911

		1910 Refined Products	1910 Metals Contained in Matte, Blister, and Base Bullion	1911 Refined Products	1911 Metals Contained in Matte, Blister, and Base Bullion
Antimony	Lb.	.....	.....	30	.....
Gold	Oz.	13,298	197,181	15,270	175,189
Silver	Oz.	16,373,799	2,136,414	17,711,077	612,401
Lead	Lb.	32,987,508		23,525,050	
Copper	"	.....	56,149,299	.....	47,788,131
Copper sulphate	"	163,228		197,187	
Nickel	"	.....	37,587,676	.....	34,098,744
Cobalt and nickel oxides	"	13,508	.....	15,174	.....
Mixed oxides of cobalt and nickel	"	108,178	.....	127,224	.....
White arsenic	"	3,003,467	.....	4,194,209	.....

TABLE IV. NICKEL PRODUCTION

	1901	1911
Ore mined	652,392	612,511
Ore smelted	628,947	610,834
Bessemer matte produced	35,033	32,607
Copper contents of matte	9,630	8,966
Nickel contents of matte	18,625	17,049
Spot value of matte shipped	$5,380,064	$4,945,592

The aggregate results of the operations on the Sudbury district nickel-copper ores during the last four years were as follows, in tons of 2000 lb.:

Exports included 27,596,578 lb. to the United States, and 5,023,393 lb. to Great Britain.

Iron

The total shipments of iron ore in 1911 are reported as 210,344 tons, valued at $522,319. These may be classified as 72,945 tons of magnetite, and 137,399 tons of hematite. Exports of iron ore from Canada during 1911 are recorded by the Customs Department as 37,686 tons. The exports were chiefly from Bathurst, New Brunswick. The shipments from the Wabana mines, Newfoundland, in 1911, by the two Canadian companies operating there, were 1,181,463 short tons, of which 765,184 tons were shipped to Sydney and 416,279 tons to the United States and Europe.

The production of open hearth and bessemer steel has been for two years as follows, in tons of 2000 lb.:

TABLE VI. PRODUCTION OF STEEL

	1910	1911
Ingots:		
Open hearth (basic)	580,932	651,676
Bessemer (acid)	222,668	209,817
Castings:		
Open hearth	18,085	13,982
Other steels	599	740
Total	822,284	876,215

The total production of pig iron in Canadian blast furnaces in 1911 was 917,535 tons of 2000 lb., as compared with 800,797 tons in 1910. Of the total output in 1911, 20,758 tons were made with charcoal as fuel, and 896,777 tons with coke. The classification of the production, according to the purpose for which it was intended, was as follows: Bessemer, 208,626 tons; basic, 464,220 tons; foundry and miscellaneous, 244,686 tons. The amount of Canadian ore used during 1911 was 67,434 tons; imported ore, 1,628,368 tons; mill cinder, etc., 30,298 tons. The coke used during the year was 1,121,321 tons, comprising 543,933 tons from Canadian coal and 577,388 tons imported coke or coke made from imported coal. There were also used 1,190,459 bu. of charcoal. Limestone flux was used to the extent of 625,216 tons.

The production of pig iron by provinces was: Nova Scotia, 390,242; Quebec, 658; Ontario, 526,635 short tons.

The exports of pig iron during the year are reported as 5870 tons. Probably the greater part of this is ferro-silicon and ferro-phosphorus, produced at Welland and Buckingham, respectively. There were imported during the year 208,487 tons of pig iron, valued at $2,610,989 and 17,226 tons of ferro-manganese, etc.

The total quantity of asbestos rock sent to mill was 1,484,691 tons; the mill production was 91,237 tons, or 6.14%. The total finished output was 100,893 tons of asbestos of all grades, and 26,021 tons of asbestic. Total exports of asbestos in 1911 were 75,120 tons, of which 62,551 tons went to the United States.

Petroleum and Cement

Production of petroleum was 291,092 bbl., 2461 bbl. being from New Brunswick and the rest from Ontario. The value of natural gas was $1,724,258 in Ontario and $96,665 in Alberta. The total quantity of gas used in Ontario was about 9869 million feet and in Alberta probably over 611 million feet.

Complete statistics have been received from the manufacturers of cement covering their production and shipments during the year 1911. These returns show that the total quantity of cement made during the year, including both Portland and slag cement, was 5,677,539 bbl. as compared with 4,396,282 barrels in 1910, an increase of 1,281,257 barrels, or 29%. Imports for the year were 661,916 bbl.; giving approximately 6,338,455 bbl. as total consumption. There were stocks of 903,590 bbl. reported at the close of the year.

Coal and Coke

Coal production in 1911 increased in Nova Scotia and Saskatchewan, and was about stationary in New Brunswick. In Alberta there was a decrease of 1,396,412 tons, or 48%, and in British Columbia a loss of 794,243 tons, or 24%; the total decrease, as compared with 1910, being 1,617,599 tons, or 12.5%. This was due to the long strike in Alberta and the Crows Nest Pass country.

The production by provinces was approximately as follows, the figures for 1909 and 1910 being also given in short tons:

Province	1909	1910	1911
Nova Scotia	5,652,089	6,431,142	6,994,120
British Columbia	2,606,127	3,330,745	2,536,502
Alberta	1,994,741	2,894,469	1,498,057
Saskatchewan	192,125	181,156	204,253
New Brunswick	49,029	55,455	55,781
Yukon Territory	7,364	16,185	2,840
Totals	10,501,475	12,909,152	11,291,553

The exports of coal in 1911 were 1,500,639 tons, as compared with 2,377,049 tons in 1910, a decrease in exports of 876,410 tons. Imports of coal during the year include: Bituminous, 8,905,815 tons; slack, 1,632,500 tons; and anthracite, 4,020,577, or a total of 14,558,892 tons.

The total production of oven coke in 1911 was 847,402 tons, as compared with 902,715 tons in 1910. The total quantity of coal charged to ovens was 1,228,700 short tons. By provinces the production was: Nova Scotia, 469,305; Ontario, 259,554 (made from imported coal); Alberta, 36,216, and British Columbia, 82,327 tons. All the coke produced was used in Canada, with the exception of 9290 tons, sold for export to the United States.

Petroleum in Peru

The development of the oil fields of Peru is increasing, according to the American consular reports. Peruvian petroleum is especially rich in the lighter distillates, kerosene and gasoline, and it is claimed that it ranks next to Russian oil for producing high-grade lubricants; that the kerosene and gasoline are superior to the best qualities imported from the United States.

Four Leading Oil Fields

There are four leading oil fields in Peru. The Negritos or Talara field lies on the coast about 40 miles northwest of Paita, the port for the department of Piura. Talara, where the refinery and wharves are situated, is a fine harbor connected by a 16-mile narrow-gage railway with Negritos. After the volatile constituents have been extracted, the residue is sold as fuel oil, mostly in Chile, whither it is taken in tank steamers for use in the nitrate works. The crude oil produced in these fields in 1909 amounted to over 100,000 tons. Some 25 miles inland from Negritos is La Brea, where a black and viscid substance like asphalt is found. So far this has been evaporated and used for coating the inside of tubs used for holding the spirits called "pisco," or "aguardiente," and in waterproofing the company's pipes, etc. It possesses good lubricating properties.

The Zorritos field lies about 25 miles south of Tumbes in the extreme northern part of Peru, and is on the ocean. At the end of 1910 there were about 45 producing wells, three of which were flowing, and producing about 15,000 tons per annum. The new wells that have been sunk into the deep sand continue to flow freely without pumping, and the same results are being obtained from experiments made in adjoining territory.

In 1910, 27,000 acres of oil land at Cabo Blanco, north of the Lobitos field, were added to the 750 acres of the original Zorritos property, and an addition to the distilling plant increased the producing capacity by 10,000 gal. of kerosene per month. Italian natural-gas engines for well boring have been introduced, and the use of natural gas permits a great saving of fuel oil, for which the demand is already much greater than the supply. The Lobitos field is situated in the department of Piura and is owned by the Lobitos Oilfields, Ltd., a British company. At the end of 1910 the company was pumping 92 wells. The quality of the oil is high, and it is all sold at good prices, chiefly in Peru, Chile, and the United States. The total output of crude petroleum of the Lobitos Oilfields, Ltd., for 1909 and 1910 was 57,226 and 53,344 tons, respectively.

The fourth important field is that in the department of Puno, near Huancane. The oil of Puno has a paraffin base, while that of the departments of Tumbes and

Piura has an asphalt base. Petroleum is also found in the districts of Pirin, Chimbote, Jauja, Huancavelica, and Ica. In fact, it seems to extend through the mineral belt of Peru at intervals from Tumbes in the north to Lake Titicaca, on the Bolivian frontier, in the south. The Peruvian wells along the coast run from out in the sea to many miles inland, varying in depth from 250 to 3048 ft. The total production for 1910 was: Crude oil, 175,000 metric tons; kerosene, 1,050,000 gal.; gasoline and benzine, 155,000 gallons.

Commercial Availability of Alunite

The treatment of the double sulphate of alumina and potash, calafatite, has already been noted in the JOURNAL (June 24, 1911, p. 1241). Somewhat similar to this is the treatment proposed by W. T. Schaller for deposits of alunite (Bull. 511, U. S. Geol. Survey). Laboratory experiments have shown that if powdered alunite be ignited, all of the water and three-quarters of the sulphuric acid are volatilized. On leaching the residue with water, about 92% of the total original potash present is obtained in the solution; that is to say, 32.7% of the ignited alunite consists of available potassium sulphate, while the remainder consists of nearly pure aluminum oxide.

EUROPEAN PRACTICE

The best European practice appears to be that in which the alunite is roasted in furnaces like lime kilns, being heated in large pieces by the flame without direct contact with the fuel, until sulphur dioxide begins to escape. The calcination requires about six hours. The mass is then exposed to the air upon a clay floor for several weeks, during which time it is occasionally moistened. The mud-like product is then agitated in boilers with water at 70° C., and the clear decanted liquid (10 to 12° Bé.) is evaporated to 32° Bé. and crystallized in small wooden tubs. The crystals are cubic, opaque and reddish from ferric oxide, which, however, may be separated by recrystallization.

Alunite is also largely converted into alum by treatment with sulphuric acid and addition of potassium sulphate. Guyot recommends the following process for this treatment: Ignite at 800° C. for three hours, thereby producing the maximum quantity of soluble aluminum and potassium sulphates. The composition of the calcined mass is determined, and acids used in proportion to the amount of soft and soluble sulphate contained. For the product of the following composition, K_2SO_4, 14%; $Al_2(SO_4)_3$ as alum, 26.55%; $Al_2(SO_4)_3$, free, 6.56%; Al_2A_3, 18.58; hydroxyl, 11.90; Fe_2O_3, 0.80; insoluble residue, 21.61%; the proportions given below would be the most satisfactory. Into a clay oven is poured 12½ tons of sulphuric acid of 52° Bé., diluted to 30° Bé., and heated to 80 or 90° C. Eight tons of the calcined mineral are then added in portions and well stirred. After all has been added, the liquid is left for two hours, then evaporated to 39° Bé. and treated with 2.7 tons potassium sulphate. After a period of 13 hours the clear liquid is decanted. Its density should not exceed 42° Bé. The muddy liquid remaining is reduced to 24° Bé. by the addition of liquid from a previous crystallization, stirred, allowed to settle, drawn off clear, mixed with the first decantation and crystallized. After one day the crystals are removal, redissolved and recrystallized. The muddy residue is crystallized out for a further crop of alum. The total yield of alum is about 2.3 times the original weight of the ore. The insoluble matter contains 3% alumina and 2.01% potassium sulphate in addition to the silica, etc.

AUSTRALIAN PRACTICE

According to C. Schwartz, the best temperature for roasting is 500° C., and the acid used should have a density between 1.297 and 1.530. The Australian treatment at Bullah Delah is as follows: The mineral is ground and calcined in reverberatory furnaces and then treated with a weak solution of sulphuric acid in lead-lined tanks, heated to the boiling point by steam jets. The liquor is allowed to settle in the same tank, and the clear solution is run off in the crystallizing tanks, which are kept in constant agitation while cooling, the alum crystallizing out and the sulphate of aluminum remaining in solution. The residue in the vat is boiled again with water and the solution run off again in the same way.

The liquor containing the sulphate of alumina is then returned to the vat, and sufficient of the calcined mineral added to neutralize completely any free acid. It is then heated to the boiling point, and the ebullition continued until partial reversion takes place, the reversion being accompanied by a precipitation of hydrated ferric oxide. The alum after collection is washed and then again crystallized for market. The sulphate of alumina solution, after all the alum has been crystallized from it, is concentrated in small vats heated with steam coils, and the lower grades of sulphate of alumina formed by running the liquor on to lead tables and making the solidified material into blocks.

While it is feasible by the addition of K_2SO_4 to convert the whole of the alumina contained in the mineral into alum, it is more profitable when the better class of sulphate of alumina can be sold at standard prices to make only as much alum as there is sulphate of potash present in the mineral, and to convert the rest into commercial aluminum sulphate. Following up Schaller's experiment, referred to above, the most desirable method would be to use the potassium sulphate as such, while the use of the alumina as a substitute for the natural bauxite for the preparation of metallic aluminum suggests itself. Bauxite itself is rapidly growing scarcer, and the deposits are of a type that may soon become exhausted.

Phthisis among Rand Miners

JOHANNESBURG CORRESPONDENCE

A preliminary report of the Rand government commission to investigate phthisis among the miners has been made. It is mainly statistical, and was prepared to afford a basis for calculating the cost of compensation to miners suffering maladies directly attributable to the inhalation of dust. The commission is of the opinion that fibrosis, resulting from the breathing of dust, may of itself be the cause of death, even if the miner be removed from underground work, but it is admitted that in recent years it has been increasingly rare to find advanced silicosis unassociated with tuberculosis.

The typical history of most of the cases examined was a beginning with fibrosis, a weakening of health and impairment of lung tissue, ending with the lodgment of tubercular germs. To describe this the term "miner's phthisis" is used. The commission examined 3200 miners, working on the Rand. Of these more than 1000, or over 30% were found to have miner's phthisis, from incipient fibrosis to advanced fibrosis and tuberculosis. Over 1000 were born in South Africa, 1300 came from England, and the rest from all parts of the world. Their previous occupations included farming, skilled labor, clerical, police, trades, and railway work. In regard to workers on machine drills, after six months' work 1½% showed the disease; after 30 months' work, 25%; after 3½ years' work, 40%; after 4½ years, 55%; after 5½ years, 64%; after 6½ years, 70%; after 10½ years, 80%; after 13½ years, 90%; and after 15 years, 100% showed the disease.

These figures are appalling, but must refer mainly to those engaged on development work, though the figures for miners engaged in supervising native laborers doing hand drilling tend to show that one of the chief causes of silicosis must be the fine dust in the atmosphere of the mines. The men engaged in hand drilling make little dust, and the miners engaged in stoping with machines in most Rand stopes, drill all wet holes, making little dust. The figures for men supervising hand stoping are as follows; after 2½ years' work, 20% showed symptoms; after 5½ years' work, 30%; after 9½ years, 40%; and after 15½ years, 50% showed symptoms.

New Publications

THIRTEENTH ANNUAL REPORT OF THE MINING INDUSTRY OF IDAHO FOR THE YEAR 1911. Pp. 135, illus. Robert N. Bell, State Inspector of Mines, Boise, Idaho.

ALUNITE. A NEWLY DISCOVERED DEPOSIT NEAR MARYSVALE, UTAH. By B. S. Butler and H. S. Gale. Pp. 64, illus. Bull. 511, U. S. Geological Survey, Washington, D. C.

PROCEEDINGS OF THE LAKE SUPERIOR MINING INSTITUTE, VOL. XVI. Sixteenth Annual Meeting, Aug. 22-24, 1911. 6x9, pp. 265, illus., paper. A. J. Yungbluth, Secretary, Ishpeming, Mich.

AMERICAN RED CROSS ABRIDGED TEXT-BOOK ON FIRST AID. Polish Edition. By Charles Lynch and M. J. Shields. 4¼x6, pp. 186, illus., paper; 30c. P. Blackiston's Son & Co., Philadelphia, Penn.

PORTLAND CEMENT: ITS COMPOSITION, RAW MATERIALS, MANUFACTURE, TESTING AND ANALYSIS. Second Edition. By Richard K. Meade. 6x9¼, p. 512, illus. Chemical Publishing Co., Easton, Penn.

PRELIMINARY REPORT ON THE ROCK ASPHALT, ASPHALTITE, PETROLEUM AND NATURAL GAS IN OKLAHOMA—By L. L. Hutchison. Pp. 256, illus. Bull. 2, Oklahoma Geological Survey, Norman, Okla.

A REPORT ON THE GEOLOGICAL AND MINERAL RESOURCES OF THE ARBUCKLE MOUNTAINS, OKLAHOMA—By Chester Albert Reeds. Pp. 69, illus. Bull 3, Oklahoma Geological Survey, Norman, Okla., December, 1910.

THE MINERAL RESOURCES OF THE PHILIPPINE ISLANDS, WITH A STATEMENT OF THE PRODUCTION OF COMMERCIAL MINERAL PRODUCTS DURING THE YEAR 1910—Pp. 85, illus. Division of Geology and Mines, Bureau of Science, Manila, P. I.

DIE WICHTIGSTEN LAGERSTAETTEN DER NICHTEREZE. By O. Stutzer. (The most important deposits of the nonmetallic minerals). Part I. Graphite, Diamond, Sulphur, Phosphates. Pp. 474 + XVI, illus. Gebrüder Bornträger, Berlin.

The above work is to be followed by other parts which will presumably take up the remaining nonmetallic minerals, but the author has been temporarily interrupted in his task by a two years' call to South Africa. To a certain extent the completed book will be complementary to "Ore Deposits" by Professor Beck, of whom Doctor Stutzer is junior colleague at the Mining Academy in Freiberg.

Doctor Stutzer's treatment of his subject is systematic and thorough. It is based to a great degree on his personal travels and bears the marks of a close observer and careful student. Under graphite, the world-wide occurrence of this mineral presents subject-matter of peculiar interest. Although in former years regarded as the result of the metamorphism of some deposit of organic origin, fuller knowledge of its relations have for some associations changed these views. When graphite appears in pegmatite dikes and in great masses of eruptive rock, and in gneisses next intrusive batholiths of granite, we seem compelled to consider some other carbon-bearing sources. Geologists in later years have therefore given attention to possible hydrocarbons of inorganic origin, and, under the guidance of Weinschenk, even to consider the possibility of cyanide compounds yielded by the igneous mass. In other cases, graphite is without doubt a metamorphosed form of coal or similar carbonaceous organic bed. Beginning with the European localities, Doctor Stutzer passes all the productive districts of the world in review, and adds statistics of output and remarks on yield and prices.

The other form of pure carbon, the diamond, presents a theme of great scientific interest and of exceptional economic importance. The South African mines naturally claim first attention and are given a detailed review. The older pipes and the newer desert gravels are both described and well illustrated. Members of the American Institute of Mining Engineers have been made familiar with these matters by the writings and addresses of Gardner F. Williams, but will be interested to see a review of all the writings which have thus far appeared. There seems to be no question that the diamond is original with the kimberlite and that it has crystallized out of an igneous magma of a basic character. Following South Africa, the gem-bearing regions of Brazil, British Guiana, the United States, New South Wales, India, and several minor districts are passed in review.

Under sulphur, the Italian localities are first treated. The greater part comes from Sicily, but the mainland also yields appreciable amounts. The Sicilian sulphur is derived from a sedimentary series of Upper Miocene age. The associates are gypsum, limestone, marls and tripoli. The sulphur has been generally believed to be derived from gypsum by the reducing action of carbon, in a reaction which first produces calcium sulphide. By the later formation of calcium carbonate, sulphur is set free. More recently the discovery of sulphur-secreting bacteria has directed attention to these organisms. There are several species whose vital processes seem to require the yellow element in their cells, and there is reason to believe that they may have been influential in producing sulphur deposits. Following Sicily, Dr. Stutzer summarizes the occurrences in Algiers, Russia, France, Spain, Austria, the United States, Mexico, Japan and several minor ones. The small workings of former years in Saba of the West Indies seem alone to have escaped notice. Of all these, the deposits and methods of mining in Louisiana possess perhaps the greatest interest and are in the most advantageous position for cheap production.

The phosphates are the last topic discussed and are certainly the most important of all the four. After a general introduction regarding the scientific aspects of the deposits, the author begins with the crystalline apatite of the ancient rocks in Norway, Sweden and Canada, and of later eruptives in Spain. All investigators must regard them as in some way after-effects of igneous action, although there is some difference of opinion whether they are analogous to pegmatites or are due to gaseous or vaporous exhalations.

The less crystalline varieties are taken next. They appear in sedimentary strata of all ages, and are derived from some organic source. The various occurrences of Germany, Belgium, France and the other European countries are first passed in review. Algiers and Tunis next receive especial attention and are followed by the United States and other American localities. Finally, Asia and Australia conclude the list. Guano is then treated by itself. The general origin of the phosphates is then discussed in connection with a scheme of classification which is as follows.

I. *Inorganic.* (1) Apatite deposits. (a) Impregnations of an eruptive. (b) Apatite veins (dikes). (2) Inorganic deposits other than apatite.

II. *Organic.* (1) Of sedimentary origin. (a) Dry land deposits. (b) Subaqueous deposits. (2) Deposits derived from original sediments by chemical rearrangements. (a) From guano. (b) From marine accumulations. (3) Mechanical concentrates from organic sedimentary deposits.

The book concludes with the following topics: Other sources of phosphates, such as basic bessemer slags; the distribution of phosphoric acid in nature; the uses of phosphates; mining and preparation; evolution and selling price; history and statistics.

J. F. Kemp.

A MANUAL OF FIRE ASSAYING. By Charles Herman Fulton. 6½x9½, pp. 219, illus.; $2. McGraw-Hill Book Co., 239 West 39th St., New York.

This is the second edition, entirely rewritten and somewhat enlarged, of Dr. Fulton's book, which appeared about five years ago. The book appears to be a satisfactory textbook for college use, as well as a desirable handbook for the practical assayer's reference. It is, of course, possible to find flaws; Van Liew's method is hardly standard as the nitric-acid combination method; the mercury-sulphuric-acid combination method is, we believe, more common than the copper sulphate-sulphuric acid combination; the method given for the preparation of proof silver seems inferior to the electrolytic, or to Knorr's method, by which the impurities in fine silver are precipitated by silver carbonate, and then the silver itself precipitated as carbonate and melted down; and parting is dismissed in a rather summary manner. But it is certain the good qualities of this book outweigh the defects, and for fire assaying it is the present standard work.

PERSONAL

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

J. B. Farish was at Phoenix, Ariz., last week.

H. W. Turner returned to London this week.

Fred Christey has returned to Phoenix, Ariz., from St. Louis, and will direct some local mining operations.

Thomas Kiddie has returned to Victoria, B. C., from a visit to his son at Morenci, Arizona.

Herbert Carmichael, provincial assayer for British Columbia, was a recent visitor to San Francisco.

J. C. Porter, of New York, left Boston March 8 for the Aguacate mines, San Mateo, Costa Rica.

R. L. Greene has resigned as a director and secretary of La Rose Consolidated Mines Co., of Cobalt.

M. K. Rodgers left Seattle, Wash., late in February, for Hedley, Similkameen, with the intention of going thence to New York.

A. Newman has resigned the management of the Cia. Minera Jesus Maria y Anexas at San Jose de Gracia, Sinaloa, Mexico.

A. G. Hillen, of Las Vegas, N. M., is in charge of properties in Eldorado Cañon, in the Searchlight camp in Nevada.

Ralph T. Hirsch sails from New York March 16 for Antofagasta, Chile. He expects to be at work in that country for more than a year.

Irving R. Gard, mining engineer on the staff of the Canadian Collieries (Dunsmuir) Ltd., has returned to Victoria, B. C., from a trip to the East.

H. H. Lavery, who recently resigned as superintendent of the Monarch mine and concentrating mill, near Field, B. C., was in Houghton, Michigan, last month.

Henry H. Armstead has been elected vice-president and resident manager of the Montana & Mexico Mining Co. operating in La Luz District, Guanajuato, Mexico.

W. J. Elmendorf, general manager of the Portland Canal Mining Co., with mine and concentrating mill in Portland Canal camp, B. C., was in Toronto early in March.

Seeley W. Mudd, of Los Angeles, Pope Yeatman, consulting engineer of the Guggenheim interests, Geo. L. Edwards and H. H. Webb have been visiting the mines at Ray, Arizona.

N. L. Stewart has resigned as engineer of the Murray plant of the American Smelting & Refining Co., to accept a similar position with the East Butte Copper Mining Co. in Montana.

C. R. Murdock has been appointed general manager of the Fairview Aztec Mining Co. He left San Francisco March 7 for Fairview to take charge of the operations at the mine.

Thomas F. V. Curran, president of the General Vanadium Co. of America, sailed from New York on the "Mauretania" this week for a month's business trip to England, Germany and France.

A. W. Constans, formerly manager of the Athabasca gold mine, near Nelson, B. C., is now manager of the Second Relief mine and 10-stamp mill at Erie, Nelson mining division, British Columbia.

D. W. Ohern, professor of geology at the University of Oklahoma, has been appointed director of the Oklahoma Geological Survey to succeed Chas N. Gould, who has resigned to enter private work.

F. William Hausman, for six years chief mechanical engineer for the Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., has resigned and will engage in mechanical engineering for himself in Birmingham.

Robert R. Hedley, of Vancouver, B. C., chairman of the Western Branch of the Canadian Mining Institute, and E. Jacobs, of Victoria, B. C., branch secretary, were in Toronto recently, attending the annual meeting of the Institute.

Albert L. Waters, of Tucson, has been appointed president of the board of regents and chancellor of the University of Arizona. He graduated from Michigan College of Mines in 1893 and is managing large mining interests in Arizona.

D. M. Philbin, general superintendent of the Lake Division of the Great Northern Ry., has been placed in charge of all business relating to the Great Northern, or Hill, iron-ore properties, in Minnesota. He will devote all his time to that department.

Prof. A. H. Purdue, who for nearly 16 years has held the chair of geology in the University of Arkansas, and since 1907 has been ex-officio state geologist of Arkansas, has been elected state geologist of Tennessee to succeed Dr. Geo. H. Ashley, resigned.

Dr. C. H. Shamel is engaged in a revision of his "Mining, Mineral and Geological Law," which is to appear soon. He requests that any readers who may have discovered errors, or have any suggestions for additional topics, communicate with him in care of his publishers, the McGraw-Hill Book Co., 239 West Thirty-ninth street, New York.

On the "20th Century" train which was partially wrecked March 7, were several prominent copper men, including Robert H. Gross, president of East Butte Copper Co.; Geo. Ruez, of Ishpeming, Mich., president of Southwestern Miami Development Co.; James Greenaway, general superintendent of Calumet & Arizona; Henry N. Sweet, of Hornblower & Weeks; H. B. Hovland, former president of Live Oak, and James Hoatson, of Calumet, Mich. None of the party was injured, although the car in which they were riding was derailed and overturned.

S. T. Wellman and his son, H. G. Wellman, have formed the firm of S. T. Wellman & Son, and will do a general consulting business in steel works engineering, with offices at 8803 Euclid Ave., Cleveland, Ohio. Mr. S. T. Wellman for over 40 years has been concerned with the construction or operation of openhearth steel works and his well known openhearth charging machine is in use in all the steel-producing countries of the world. He is still chairman of the board of directors of the Wellman-Seaver-Morgan Co., but the business of the new firm is entirely distinct from that of the above company.

OBITUARY

H. L. Whiting of Bradford, Penn., a well known oil producer and operator, died at Harrisburg, Ill., March 10, as the result of an attempt to rob him, in which he was severely handled. He had gone to Illinois for the purpose of buying and leasing oil lands.

Joseph Ford, well known in the charcoal iron industry, died at Grand Rapids, Mich., March 5, aged 60 years. He was president of the Spring Lake Iron Co., with a charcoal furnace at Fruitport, Mich., and also president of the Mitchell-Diggins Iron Co., with a furnace at Cadillac.

Wade Hampton Echard died at Uniontown, Penn., March 10, aged 36 years. He was born in Uniontown, educated in Pittsburgh and at West Virginia University. His father and uncle were large coal operators. He was president of the Unity Coke Co., the Northern Coke Co., the Peerless Coke Co. and the Franklin Coke Co., all of Connellsville.

William Ashley Whitley, one of the California pioneers, died in San Francisco on Feb. 23. He was 72 years of age, having gone to California from Missouri in 1861. During the years that followed he was prominent in mining on the Comstock and elsewhere in Nevada, California, and Montana. He was a close friend of George Hearst, and was an intrepid explorer and adventurer. During recent years he was engaged in the contracting business in San Francisco.

Societies and Technical Schools

British Columbia Mineowners' Association—This association, after having been inactive a number of years, has been reorganized, with the following officers: President, S. S. Fowler; vice-presidents, R. H. Stewart and W. E. Zwicky; secretary-treasurer, Jas. Anderson; other members of executive board, A. H. Gracey, Frederic Keffer, John L. Retallack, G. Stilwell, and William Watson.

Editorial Correspondence

From our Representatives at Important Mining Centers

San Francisco

Mar. 6—Much of the anxiety of mining operators has been relieved by the rain and snow in the last week. The situation had come to be rather serious in some of the mining districts that are dependent on water for power and for milling, but there has been no time when there was an actual water famine in the last year in any of the districts. The present rain began in the extreme southern end of the state and extended gradually to the northern limit and to the foothills of the Sierra on the east. The fact that there was rain instead of snow at elevations as high as 5000 ft. was rather discouraging to the mining industry; but at higher elevations, and in some sections at much lower than 5000 ft., there was sufficient snow to offset the rain. At the end of February the report of the U. S. Geological Survey showed that the precipitation of snow and rain for January and February was only 35% of the normal; that at the same date in 1911 there were 240 in. of snow at the summit of the Sierra, while in 1912 the amount was not much in excess of 12 in. This fact has been dwelt on with more than necessary emphasis, because 1911 was not a normal year.

The recent snowfall, though not great, is sufficient to prevent such a shortage of water as would be disastrous to mining operations. There is no doubt that the water supply for 1912 will be less than in 1911; but there is one condition not generally recognized, which will enable operators to proceed even though there should be an actual shortage, and that is progressive development. There has been no season in recent years when California mines were so well situated in this respect. The older active mines are generally in such condition that a reduction in the tonnage treated would not affect seriously the financial situation of the owners. Mines that are operating 60 or 100 stamps could reduce the number from 25 to 40%, continue the exploration of new ground and the development of the present workings, and thus add to the future ore reserves without detriment to finances, and with improvement in physical conditions. There are numerous old properties that are being reopened whose progress would not be retarded by delaying production and continuing development. And in some instances delay would be more an advantage than a detriment, as the inclination to install treatment plants at mines that are only partially developed is still alive in various parts of the state. Considered in all its aspects, quartz mining in California in the present season is so thoroughly prepared that nothing short of an actual water famine can affect it disastrously.

Denver

Mar. 8—The snow fall in the mountains having been exceptionally heavy during the winter, and as the ground is now beginning to get warm, the usual results have come. Avalanches are sweeping down the mountain sides, and the high mines are suffering. At Crested Butte, six men at the Buckley mine were carried away, and four of them were buried under 20 ft. of snow, but 200 men employed in the rescue finally got them out alive, one man dying later from his injuries. The Chalk Creek mining district, including St. Elmo, Romley and Hancock, are cut off from food and fuel supplies by the enforced abandonment, owing to snowslides, of the 30 miles of Colorado & Southern Ry. serving the district, and the Mary Murphy mine employing 200 men is out of coal and will have to close down.

Between Durango and Silverton 10 snowslides ran over the railway, covering the track from 3 to 30 ft. deep, and damming the river up until the water rose over the rails. An avalanche 150 ft. wide and 30 ft. deep ran in Ten Mile Cañon, blocking the Colorado & Southern Ry. between Leadville and Breckenridge. At the Cimmaron and Seventy-six mines, in Marshall Basin near Telluride, two avalanches ran, carrying away three houses of the Smuggler-Union mine, and a miner named Edwin Thomas was buried in the snow and it is believed has perished. Between Vance and Ophir, in the same district, the railway to the south has been closed by avalanches half a mile in extent, and as all telephone lines are down, it is feared there are more disasters to be heard from.

The Philadelphia Mines & Tunnel Co., of which Ernest Le Neve Foster is president, filed its annual report with the secretary of state, who refused to accept it on the grounds that the company was in arrears on its flat taxes. The mining company then applied for a writ of mandamus to compel Secretary Pearce to accept the report and the $5 fee, but by a decision of District Judge George W. Allen, the secretary of state was upheld in his refusal.

In addition to the large order for steel rails placed by J. J. Hill with the Colorado Fuel & Iron Co. about a week ago, President Bush, of the Denver & Rio Grande R. R., has ordered 125 miles of new rails to be delivered in June and July. This steel will weigh 15,000 tons and will cost about $500,000. Most of this is for double tracking on the main line.

Butte

Mar. 6—Clifton Applegate & Co., of Spokane, have secured the contract to build the Georgetown extension of the Butte, Anaconda & Pacific R.R., and will begin the work at once with the expectation of having the line graded and ready for the rails by the early autumn. There will be 17 miles of grading from the present terminal, six miles west of Anaconda, to the Southern Cross mine, the end of the line, and the grade will average slightly under 2%. Four grading camps are being established and the contractors have called for station men to whom subcontracts for grading will be let. There are no tunnel sites on the line, but there will be 10 bridges and a great many cuts, some of which will be several hundred feet long.

There has been a somewhat larger flow of mine water lately at the Pennsylvania mine of the Anaconda, due to the tapping of unexplored veins by the diamond-drill hole, which is being driven south from the end of the south crosscut on the 1800-ft. level. About 275 gal. per min. are now being pumped from the 1800- to the 1200-ft. level, where it enters the new flume transporting it to the Leonard pumps; as the electric pump on the 1800-ft. level, which has a capacity of 250 gal. per min., is not quite able to take care of the increased flow, it has been found necessary to run for one hour per day the two new air pumps recently installed for such an emergency. These pumps have a capacity for pumping 150 gal. of water per min., and a third pump of the same capacity has also been installed and will be ready for use as soon as connected.

There is a large quantity of second-class ore blocked out in the Tuolumne mine, which has not been touched yet, owing to the lack of favorable smelting arrangements; however, as this class of ore is constantly increasing in amount as mining proceeds, the company

is endeavoring to arrange with the Anaconda company for its treatment at the Washoe smeltery. In the event of reaching no agreement, it is possible that a combination of the Tuolumne and several other mining companies will be effected for the purpose of erecting a concentrator of their own. It is being planned to increase the tonnage somewhat.

Salt Lake City

Mar. 7—Articles of incorporation of the St. John & Ophir R.R. Co. were filed Mar. 5. The company will build and operate a 10-mile branch road from St. John on the Salt Lake route to Ophir in Tooele County. The company may also build and operate telephone and telegraph lines, own water rights, etc. The capitalization is $150,000, divided into 1500 shares, par value $100. The officers of the company are: J. Ross Clark, president; C. O. Whittemore, vice-president; W. M. Comstock, secretary and treasurer. It is said that the road will be completed in three months. Increased activity in the Ophir district will result. The present transportation is by means of a traction engine and ore wagons. The principal shipper at present is the Cliff mine, whose normal production is about 70 tons per day. This property has recently developed new bodies of silver-lead ore on the lower levels, 600 ft. from the surface, and has been shipping about 1000 tons per month. The Ophir Hill is in shape for active production, having overhauled its mill and driven a 3000-ft. drain and transportation tunnel connecting with its lower workings. The Lion Hill Consolidated has been developing its property, and making occasional shipments. Work will undoubtedly be resumed at other properties.

Shipments of ore and concentrates from Park City mines during February, aggregated 9442 tons, which is above the average of approximately 8000 tons per month. The principal shippers were the Daly West, with 3385 tons; Silver King Coalition, 2962 tons; Ontario leasers, 309 tons; Little Bell, 110 tons; Daly-Judge, 2333 tons; New York Bonanza, 131 tons; Grasselli Chemical Co., 183 tons; leasers made up the balance. A number of properties have been unable to ship because of heavy snows.

The local U. S. Land Office has received notice that, by order of President Taft, approximately 60,000 acres of land in Wayne and Emery Counties withdrawn some time ago as coal land, have been restored to entry. In Iron County approximately 200,000 acres have been withdrawn from entry under Section 6 of the Enlarged Homestead Act. Recent investigations have shown that there is sufficient water on the land to make residence possible. Water may be found in most places at a depth of from 30 to 50 ft. The order revokes the one issued Sept. 20, 1909, under which the land was thrown open to entry under nonresidence conditions.

Houghton, Mich.

Mar. 9—Recent operations at the property of the Isle Royale Copper Co. are exciting more than ordinary interest. Periodically this mine occupies the limelight, because of either reported improvement in underground developments, or further economies in operation. When all is said and done, the old truth always floats again—namely that the Isle Royale lode is a low-grade, bunchy deposit. This should not detract, however, from the excellent results that it is generally believed have been obtained during the last year. Through careful underground supervision further economies have been possible, and the company is expected to show a substantial profit for the year, despite the low price for copper. There can be little doubt that such a satisfactory showing is due largely to the close personal supervision which the direction of the work receives from the local officials in direct charge at the mine.

The idea that the capacity of the present mill can be increased by the addition of more stamp heads is hardly tenable in view of the careful government regulation and supervision over the deposition of tailings in the waters of Portage Lake.

Negaunee, Mich.

Mar. 9—The Breitung companies, operating on the Marquette Range, have sold enough ore for delivery during the coming season to insure the employment of good-sized forces of men. During the season of 1911, when general conditions in the iron market were slack, the Breitung mines were working at full capacity. The Breitung-Hematite No. 1 mine reports sales of bessemer ore for 1912; this ore has the remarkably low phosphorus content of 0.015%. The Mary Charlotte mine reports sales of high-grade and medium-grade ore, as does also the Washington Iron Co., operating mines at Humboldt.

The underground fire at the Mansfield mine of the Oliver Iron Mining Co., in the Crystal Falls district, was smothered by covering the shaft. A special train had been run from Iron River with rescue apparatus, but it was not needed, as all of the men got out safely; two mules were drowned on the bottom level, which flooded, due to the breaking of a pipe by a falling cap, from under which the fire had burned the posts. The fire in the shaft was sprinkled with water, obtained by lowering the skip to the flooded level. The air was finally judged to be clear when a lantern lowered and pulled up was found still burning.

The Oliver Iron Mining Co. is doing considerable diamond drilling in the region around Republic. The work is directed from the Duluth office, and is largely on the lands of the Michigan Iron & Land Co. Two drills are working near Trout Lake, four miles west of the Witbeck mine; one on Sec. 31, T. 47-R. 30, south of the Norman Iron Co.'s tract which Jones & Laughlin are exploring; one on Sec. 1. T. 46-R. 31, about one mile to the southwest; one at the old Riverside mine, three miles northwest of Republic, and one drill which was working at the old Standard mine, in the same vicinity, has been transferred to Lake Michigamme, where it is drilling a vertical hole through the ice, two miles east of the village of Michigamme. The Cole & McDonald Exploration Co. has the contract for drilling. Both the Oliver Iron Mining Co. and the Jones & Laughlin company have been carrying on dip-needle work southwest of Republic. The iron formation there is narrow and has few outcrops.

Cobalt

Mar. 8—The Cobalt Mine Managers' Association will enter a protest against the proposed amendment to the Mines Act, which has been introduced in the legislature by Sir James Whitney. The amendment provides that no man employed underground shall work more than eight hours in 24, including the time going down and coming out of the mine. The members of the association state that a change in the working hours would necessitate a corresponding cut in wages. The present scale of wages paid is that adopted by the Cobalt Miners' Union for a 9-hr. day, the lowest wages being $2.75 for shovelers, while machine men get $3.50. The local union has representatives in Toronto, in behalf of the amendment.

Porcupine

Mar. 8—Operatons at the Dome mine have now advanced to the stage where ore is being hoisted from the mine and sent to the mill bins. The mill will not start till about Mar. 20, but the crushing equipment is practically complete, and the bins, which have a capacity of 1500 tons, will be filled in readiness. To date, most of the work in the mine has been confined to the 50-ft. level, above which at least two years supply of ore has been blocked out. The second and third levels are now being drifted upon and connected to the main 8x18-ft., three-compartment shaft. The ore is hauled through an inclined tunnel to the crusher stations, and the crushed product is transferred to the mill by a conveyor belt. All the work on the property is progressing smoothly, and when production actually starts, the equipment will be in such shape as will permit of continuous work. At present there are five diamond drills in operation, which are exploring the ground between the present workings and the Dome Extension boundary.

The Mining News

The Current History of Mining

Alaska

During February, shipments of copper ore to the United States were 5082 tons, containing 2,802,361 lb. of copper worth $378,319.

Owing to the lack of snow in the vicinity of Seward, mining operations will begin this year at a much earlier date than ever before in the history of this section. The winter has been the most open experienced for many years, allowing a great deal of surface work to be done at the various mines.

Alaska-Treadwell—During January 58,360 tons of ore were crushed, yielding $132,543 gross and net $28,142. Operating expenses were $97,462; construction, $6938; yield per ton, $2.29; development work, 992 feet.

Brewer-Alaska—This company is making preparations for extensive development work on the property at Mile Seven, on the Alaska Northern Ry. R. G. Dougherty is superintendent.

Rice—This company has purchased a stamp mill and other machinery which is now being transported to the mine in the Porcupine district on Kenai Lake. Dan Rice is in charge.

Arizona

Gila County

Four different companies are conducting exploratory work, with six "Star" churn drills in continuous operation. The Miami company is working one drill northeast of the orebody, on ground whose surface indications are considered favorable for the development of another body of ore. The New Keystone is operating one drill northeast of the shaft. The Southwestern Miami, whose property lies to the southwest of the Live Oak, is running two drills and intends to add another as soon as possible. The General Development Co. is operating two drills on the Barney group, lying west of the Live Oak. In addition to these, there are possibilities of others being added soon.

Inspiration Consolidated—At the stockholders' meeting of the Inspiration Copper Co. and the Live Oak Development Co., recently held, the sale of all the properties and assets of these companies was authorized and has now been made to the Inspiration Consolidated Copper Co. All of the Live Oak shares, except 25, have been exchanged for the Consolidated company stock and all of the Inspiration Copper shares except about 5000 have been exchanged. The Consolidated company will hold its offer open for a short time. About $5,950,000, face value of Inspiration Consolidated Copper Co.'s 6%, first-mortgage gold bonds were subscribed for by stockholders, so that only about $50,000 of these bonds will go to the underwriters.

Barney—Hole No. 1 is 1175 ft. deep and is in iron-stained silicified schist. At 1030 ft., it was thought that the hole was in granite, but this was found to be only granite boulders included in the dacite flow near its bottom. The chances are now considered favorable for finding ore at a little greater depth. Hole No. 2 is 130 ft. deep and is in the Gila conglomerate. It was near this hole that a hole drilled by the Barney Copper Co. is reported to have discovered ore at a depth of 500 ft., penetrating it for a distance of 20 ft. before it became necessary to abandon the hole on account of caving.

Superior & Boston—Development work continues on the 12th level. The crosscut north from the McGaw shaft is in about 300 ft. and has not yet cut the old Dominion vein. The drift that is being driven west on the Great Eastern vein is in 125 ft. and breasted in 4 ft. of soft, altered and mineralized diabase, containing considerable hematite.

Miami—The mine is producing 3000 tons per day, and the concentrator is in full operation. Three of the shrinkage stopes above the 420-ft. level are producing, and a large amount of ore is derived from the operation of interposing a mat of square sets between the ore and the capping. In the sixth unit of the concentrator the mill superintendent is experimenting with the view of introducing graded crushing to a greater extent and also the roughing system, which is not at present used here.

Live Oak—The work of enlarging shaft No. 2 is expected to be finished this month. It is being done by raising from three points in the shaft. The surface equipment is being erected. The two 150-hp. boilers have been bricked in and the 15x20-in., double-drum hoist is being assembled.

Maricopa County

Col. William F. Cody (Buffalo Bill) has installed a drilling outfit of 3000 ft. capacity at Agua Caliente, west of Phœnix, and will drill for oil. Gas has been struck in a water well in the Verde Valley, near Camp Verde, northeast of Phœnix.

Copper Top—Work will be resumed on this copper mine about 20 miles north of Phœnix, in the Rogers Spring District. A 25-ton smeltery is at the property. H. H. Uddel, of Phœnix, is in charge.

Union—Leasers are working on this old mine north of Phœnix.

Fortuna—This and the Gila Monster properties in the Rogers Springs District are idle but resumption on the Fortuna is planned.

Contention—This mine, near the Fortuna and Gila Monster mines, has been entirely abandoned after expensive explorations.

Mammoth—This mine at Mesa, east of Phœnix, is being extensively developed by George V. Young, formerly secretary of the territory. The ore yields gold, chiefly, and lies in a brecciated zone along a granite contact. The deposit is low grade but extensive, except as to a rich gouge streak along the hanging wall, from which in early days high-grade ore was taken. Negotiations for the sale of the property are under way. In the meantime the development is being vigorously carried on. The mine is on the government road to the Roosevelt dam.

Pinal County

Ray Consolidated—During January production amounted to 2,476,944 lb. of copper as compared with 2,271,654 lb. in December. The blowing-out of a motor prevented greater production. Since Feb. 12 the concentrates have been shipped to the Hayden smeltery of the American Smelting & Refining Co., where they will be held until the plant starts. Four units of the concentrator are running and costs are said to be under 9c. per pound.

Yavapai County

Monte Cristo—This silver property near Wickenburg is being extensively developed by Ezra W. Thayer of Phœnix. It is now down to the 500-ft. level. Mr. Thayer proposes to continue development to the 600-ft. level and to drift the full length of the oreshoots now opened, nearly a claim's length, before taking out any ore; an extensive mill is being considered and an aërial tram project is planned to carry the ore to Wickenburg about 12 miles distant. This is considered one of the most successful recent operations of development in the southwest. It was begun about two years ago when Mr. Thayer bought the property from a Mexican.

California

Amador County

Original Amador—The action of J. E. Bullard to quiet title to the Eclipse, Eclipse Extension and Last Chance quartz claims has been decided in the Superior Court, quieting the title in this company.

Bunker Hill—The repair of the working shaft damaged by a falling skip on Feb. 7, has been completed, and solid bracing has been added to prevent a like result should another accident of the same character occur. The unwatering of the 1950-ft. level, which was flooded during the period of repair work, proceeded preparatory to the resumption of ore extraction and milling. E. Hampton, Amador City, is superintendent.

Butte County

Mammoth Channel—The crosscut tunnel has opened up some good gravel, which washes free and carries colors. There are indications that the breast is in the outer rim of the Perschbecker ancient channel. Capt. J. R. Foster, of Marysville, is manager.

Calaveras County

Delmonte—Preparations are being made to develop this former producer, at Railroad Flat. A winze will be sunk with air drills from the crosscut tunnel. The mine is equipped with a good 10-stamp mill. Fred W. Wright is manager.

Petticoat—A concrete foundation has been built for the engine; the boilers will be set in soapstone, a material that has been satisfactory in other installations. A new shaft will be sunk 300 ft., to connect with the south level.

Eldorado County

Carpendar-Kumfa—Work has been resumed after a shutdown of two weeks, resulting from electric power-plant troubles.

Inyo County

Panamint—It is reported that J. K. Turner, engineer for A. D. Myers, of Nevada, has arranged for the purchase of these old silver mines by Mr. Myers. The mines are situated on the west slope of the Panamint Range, near the base of Telescope Peak, about 11 miles distant from Ballarat. The nearest railroad station is Randsburg, about 70 miles southwest. Mr. Myers has been exploring the property under bond for the last nine months. The old workings have been cleaned out and stopes opened to the surface.

Placer County

Pioneer—The mill at this mine, in the Humbug district, seven miles from Towle, resumed crushing on Feb. 23, after a shutdown of several weeks from lack of water. Thirty men are employed, and H. W. Morris is superintendent.

Cache Rock Dredging & Mining Co.—This incorporation, with head office at Oakland, has leased the dredge and the land of the Eldorado Placer Dredging Co. The gold-saving tables are being remodeled by George L. Holmes, consulting engineer, and the dredge was expected to resume operations about the first of March. A. W. Copps is general manager.

Sierra County

Rainbow—Through a reorganization the operating company has taken in sufficient capital for thorough development. Electrical machinery and machine drills are being added, the stamp mill is being overhauled, all tunnels have been retimbered and new steel rails have been laid. L. P. Woodbury is superintendent.

Sovereign—Shortage of water for power has curtailed operations. A cleanup of over $800 has just been made from an 8-day run, with the single Beers mill running two 8-hour shifts. F. O. Richardson is in charge.

Siskiyou County

Blue Ledge Copper—This company has secured patents to 17 copper claims on Joe Creek, and it is reported that a smelting plant will be installed. A large amount of development work has been done and a water system has been installed, besides the erection of a number of surface buildings.

Trinity County

Trinity Gold Mining & Reduction Co.—The report for the year ended Nov. 30, 1911, shows net profits of $66,264. These came from six months' operation. Fixed assets were increased by $42,668 and indebtedness reduced by $10,930.

Tuolumne County

Harvard—The 1200-ft. shaft will be deepened 300 ft. Surface improvements are also in preparation, including the installation of concrete foundations for 30 stamps, to conform to the 30 stamps already so placed. About 150 men are employed; H. W. Gould, Jamestown, is superintendent.

United Gold Mining & Milling Co.—Development of the Tarantula mine near Chinese Camp continues. The shaft is over 950 ft. deep and still sinking, while drifting to the north is in progress. William Blackmar is in charge. The same company is doing drilling and prospecting on the gravel deposits at Yankee Hill, near Columbia, and active mining operations will be inaugurated soon. F. J. Dondero is in charge of the latter work, and Chester B. Allen is general manager and consulting engineer.

Yuba County

Red Ravine Mining Co.—This company, which has been developing the Red Ravine property, in the Indiana Ranch district, has been reincorporated with capital stock $500,000, chiefly subscribed by Marysville men, including R. R. Raish, H. A. Bruce, M. T. Brittan and others.

Yuba Construction Co.—A number of men have been returned from the San Francisco office to the shops at Marysville, including draftsmen and heads of departments. New orders are in for dredges. J. H. Hinton is superintendent.

Colorado

Cripple Creek

Modoc—A rich strike is reported in the fifth level; the width of the ore is 4 ft., and the grade is estimated at about 2 oz. of gold per ton.

Trilby—Superintendent Williams is sinking the shaft 3 ft. per day, beginning at 940 ft. and it will be continued to 1100 ft. A winze was sunk 45 ft. on the ninth level and a test car of ore showed $20 per ton for the rock, after being separated from the rich screenings.

Lucky Gus—E. S. Chillson has taken a lease on the Joint shaft on this Bull Hill mine and has installed a 15-hp. electric hoist and commenced work at the 350-ft. level.

Old Gold—This mine on Beacon Hill has been leased for three years to Oscar Fogleman, of Cripple Creek, who will commence work soon. John M. Roach, a street railway man of Chicago, is said to be associated with Fogleman.

Elkton—The large oreshoot developed in the upper levels has been developed for 1000 ft. on the 10th, or 950-ft. level, and is stated to be 5 ft. wide, containing 2 oz. of gold per ton.

Stratton's Independence—Conditions at this mine, under the management of P. H. Argall, are better than for years, and a new discovery has just been made on the 200-ft. level of a shoot of pay ore, which, it is said, will furnish heavy output for at least six months.

El Paso—The February output was 103 cars of 1-oz. gold ore. The drift on the 1000-ft. level has a pay shoot 3 ft. wide, which has been opened for 50 ft.

Jerry Johnson—L. S. Cox, lessee on a block of ground taken over from the Damon mine by this company, has opened a flat vein of gold ore 4 ft. thick.

Blue Flag—The company's cyanide mill, on Raven Hill, is said to be treating 40 tons per day of $4 ore from a new orebody recently opened.

Clear Creek & Gilpin Counties

Saxon—This mine is said to have been purchased by Poindexter & McDonald, of Seattle, who will expend $30,000 in development.

Lincoln—Owing to the heavy cost of pumping and hoisting, the shaft at this mine was abandoned 10 years ago. A crosscut tunnel will be driven to intersect the 500 level of the shaft, and the ores left in the mine will probably be extracted profitably.

Lake County—Leadville

About 18 miles south of Leadville, near Winfield, D. Johnson and associates are working a property which produces ore, assaying 7% molybdenum and from ½ to 3 oz. of gold per ton. The property has been idle for many years, but a company is being incorporated to work it again.

Hellena—The mill buildings are ready for the machinery, and men and teams are at work digging the snow out of the road so that the material can be hauled in.

Across-the-Ocean—This mine is making regular shipments to the Arkansas Valley smeltery each month, the output for February being about 100 tons of $25 ore. Ten men are at work under Manager Gilroy.

Fairplay—Three cars have been shipped from the new strike in this mine, in Stray Horse Gulch. The orebody is 4 ft. wide, and carries silver, gold and lead ore.

Dome—Development work on this mine, on Rock Hill, is going on steadily, the quality and quantity of the product being the same as for some time past.

Louisville—The mine is shipping regularly and the lessees are keeping development ahead of extraction.

Saguache County

Raleigh—Reports state that a large orebody has been opened in this tunnel, at Bonanza. The vein is said to be 30 ft. wide, 15 ft. of which carry lead, zinc, gold and silver. This ore was struck 3000 ft. from the portal. It is 15 miles from the railway at Villa Grove. The property is owned by the Raleigh Mining & Tunnel Co., and New York men are interested.

San Juan Region

Tomboy—During February the mill crushed 8200 tons of ore, yielding bullion worth $18,000. Concentrates worth $60,500 were shipped. Expenses were $46,000; profit, $32,500; permanent improvement, $263.

Bagley—This tunnel at Animas Forks has been completed by Manager Charles Gagner, and he is now about to erect a mill to treat the ores of the many veins intersected.

Idaho

Columbus—The tunnel being driven on this property has encountered the orebody; the latter is 5 ft. wide and will concentrate four tons into one. The length of the orebody has not yet been determined. The property is in the Murray district and is on the proposed line of the new railroad which is to tap the north side mines.

Michigan

Copper

Arcadian—Two copper-bearing formations have been cut by drilling. One was reached at a depth of about 1000 ft. on the southeastern part of Section 9, which is at the northern end of the property and a part of the section that had not been explored. This lode at the point of intersection is about 12 ft. wide, 7 ft. of which carry copper. The second strike was made recently at the southern end of the property, in proximity to Portage Lake.

Houghton Copper—Drifting in both directions at the 600-ft. level continues to open good ground, and a small stockpile is being accumulated. The shaft is concreted for a distance of about 300 ft. and is to be concreted for the entire distance, owing to the badly broken character of the ground in which the shaft was sunk.

Ojibway—No. 1 shaft is down to the 1600-ft. level, and the crosscut from this level should reach the lode within a few days. An exploratory drift is being driven from the 1700-ft. level of No. 2 shaft.

Oneco—Shaft sinking continues and copper has appeared from time to time; at the 900-ft. level good ground has been exposed, but no attention will be given to lateral openings until the lode, which yielded a rich core about two years ago, is reached; this is about 1200 ft. below surface.

Mass—The annual report for the year ended Dec. 31, 1911, is expected to show: Copper sold, 1,326,898 lb.; total receipts, $364,764; expenses, $464,123; deficit, $99,359; previous surplus, $130,069; total surplus, $30,710. An average price of 12.76c. per lb. was received for copper during the year.

Tamarack—The report for the year 1911 shows: Total receipts, $957,916, compared with $1,435,035 in 1910; total costs of $1,159,090 against $1,607,282 in 1910; deficit, after all charges, of $201,173 against $191,348 in 1910; assets, $1,462,163 against $1,579,715 in 1910.

Hancock—The report for the year ended Dec. 31, 1911, shows total receipts of $324,497. Disbursements were: Superintendence, office, legal, mining, transportation and smelting expense, $117,406; interest, $1760; taxes, $24,356; construction and development, $215,754; total, $359,278; excess disbursement over receipts, $34,780. The test mill-run yielded 754,749 lb. refined copper from 41,449 tons of rock, an average of 18.21 lb. per ton.

Osceola—Judge Weist, of Lansing, Mich., has issued an order restraining the holding of the annual meeting, scheduled for Mar. 14. Application was made by Charles M. Turner and other Michigan stockholders, who were opposed to the consolidation plan a year ago.

Superior—The report for 1911 shows: Total receipts, $430,884; total expenses, $482,873; deficit from operations, $51,989; balance of liabilities Dec. 31, 1911, $73,089; tons stamped, 162,599; refined copper, 3,236,233 lb.; total cost per lb., 15.31 cents.

Isle Royale—The report for 1911 shows: Total income, $969,365; mine expenses, smelting and transportation, $762,397; gross operating profit, $206,968; net profits, $156,708; balance of assets, Dec. 31, 1911, $137,976; tons of rock stamped, 457,440; fine copper, 7,490,120 lb.; cost per lb. at mine, 8.97c.; total cost per lb., 10.85 cents.

Adventure—The report for 1911 shows: Total expenses, $64,402; total receipts, $2849; deficit, $61,553. The assessment of $100,000 due July 20 resulted in the balance of assets amounting to $72,375 as against $33,929 at the end of 1910. A Kimberly skip has been installed.

Iron

It is reported from Ishpeming that the Oliver Iron Mining Co., a Steel Corporation subsidiary, has announced its intention to reduce working hours for underground men to three 8-hour shifts per day with no wage reduction. It is said that this will affect 10,000 men.

Davidson Ore Mining Co.—This subsidiary of the New York State Steel Co., operating the Gleason and Goodman properties, north of Iron River, has contracted to take electrical power from the Peninsula Power Co., of Iron Mountain. An electrically driven compressor has been ordered.

Bristol Mining Co.—This Oglebay-Norton subsidiary, at Crystal Falls, recently requested from the city council the refund of $12,186, because of alleged irregularity in the assessment of the taxes in 1911. It was stated that the Bristol mine was assessed at 75% of its true cash value, while general property was assessed at about 40%. The council replied that the matter was beyond the jurisdiction of the city, as the valuation of mines had been made by the State Tax Comission, and the refund was denied. Attorney I. W. Byers, of Iron River, appeared for the mining company.

Sheridan—At this property, south of Iron River, Alexander MacKinnon, who owns the mine, has let a contract to the McPherson Exploring Co. to put down several diamond-drill holes. The first hole has been started and is reported to be in ore formation. The mine was worked several years ago, and there is a shaft and headframe on the property.

Jones & Laughlin—At the Iron River property of this company, the shaft which is being sunk is down 110 ft. Work has been started on the combination engine

and boiler house by J. S. Wahlman, contractor, of Ishpeming. The building will be of frame with iron sheeting; Will Walters is superintendent.

Rogers—At this mine, of the Munro Iron Mining Co., near Iron River, the 11x16½-ft., 5-compartment shaft, being sunk in rock, has cut out the first level and is sinking for the second.

Austin—This and the Stephenson mines are at present the only operating mines in the Swanzy district and both are owned by the Cleveland-Cliffs Iron Co. At the two shafts, near Cyr, recently sunk to bedrock by the Foundation Co., sinking in rock is in progress, using the temporary compressor plant that was used for the caisson work. One shaft is reported to be encountering considerable water, while the other, only a few hundred feet distant, is giving no trouble.

Missouri

Rider Mining Co.—This company, operating a mine at Pioneer, Berry County, has completed the erection of a $20,000 mill.

Short Creek Mining Co.—This company, operating on the Connor land, at Central City, has incorporated for $15,000. W. J. Von Borries, of Joplin, is manager.

Montana

Butte District

Anaconda—At the Pennsylvania mine, 876 ft. of sill work was done during February, of which drifting constituted 644 ft.; crosscutting, 121 ft., and raising, 111 ft. There are about 490 men on the payroll at present, and 1100 tons of ore are being hoisted daily. On the 1000-ft. level an electric motor has been installed for ore hauling, taking the place of horses. This addition makes a total of three such motors in use at the mine, the other two being on the 1600-ft. level. The air shaft, which was raised from the 1600-ft. level, three compartments wide to the 1400-ft. level, is being enlarged to the same dimensions from the 1400-ft. level to the surface by cutting out a third compartment on the east end. This work has reached a point about 60 ft. above the 1200-ft. level, and will be continued without interruption until completed, after which it is the intention to install an air hoist and to use two compartments of the shaft for hoisting purposes, leaving the third for air lines and electric cables.

United Copper—Omission in paying the New Jersey State franchise tax has resulted in the Governor's declaring the charter forfeited. When interviewed, Mr. Heinze stated that it was undoubtedly due to a clerical error and that the company had no intention of permitting the charter to lapse.

Tuolumne—The east drift on the 1800-ft. level recently encountered a fault, which, upon investigation, was found to have caused a north displacement of the vein; by crosscutting through the fault, the vein was again picked up and found to be much wider and richer. With the amount of development work already done, it has been shown to be the finest body of ore yet encountered in the property. For a width of 4 ft. it averages 12.7% copper; 6 ft. averages 5.75%, and there is also a good silver content. This orebody is the same as the one on the 1600-ft. level, from which a heavy tonnage has been mined and shipped, but it is both wider and richer on the 1800-ft. level.

Deer Lodge County

Trilby—Development work has been going on for several months at this mine, in the Georgetown district; a crosscut from the bottom of the shaft, which is 44 ft. deep, recently encountered the vein, and a small amount of drifting has been done with encouraging results. There has been such an increase in the flow of water, however, incident to tapping the vein, that the buckets cannot handle it, and it is probable that operations will have to be suspended until the pump, which has been ordered, can be installed. It is the company's intention to leave the ore mined in the immediate future on the dump until the coming of the Butte, Anaconda & Pacific R.R. cheapens transportation.

Jefferson County

Grand View Mining & Development Co.—This company has been incorporated recently with main office at Whitehall. The incorporators are Henry Schmidt, Jack Bradley, Jesse Johnson and Dan Minier, of Whitehall, and Cladius Bros., of Ritzville, Wash. The company is operating its group of nine claims in Goodrich Gulch, 20 miles south of Whitehall. Three tunnels have an aggregate length of 1000 ft. The ore is lead-gold and a quantity is on the dump.

Nevada

Comstock Lode

Ophir—Run 37, consisting of 2000 tons of ore at the Kinkead mill, has been completed, and the returns from concentrate and bullion shipments to the smeltery give a net yield to the company, less freight and treatment charges, of $53,903. One bar of bullion shipped netted $6169. Sill-floor sets are being installed on the 2100-ft. level of the mine, in the ore recently opened in the west crosscut from the south drift, and a raise will be carried up in the pay ore.

C. & C.—Shipment from the factory of the new centrifugal pumps with motors has been promised for March, and they will be installed at once. The new electric cable to connect with the new pumping plant has arrived, and is the largest yet used in the district. It is 4000 ft. long and weighs 14 lb. per lineal foot. The cable is being installed and will connect with the pump stations of this shaft and the old joint Ophir and Mexican winze, at the head of which one pump will be placed, recovering the levels below the 2500. It is expected that the new system will be working in about three months.

Con. Virginia—The raise in the ore on the 2400-ft. level has been carried up to the second floor, and second-class ore is being extracted. On the 2300-ft. level, an old west crosscut is being reopened, and it is proposed to explore the main Comstock vein at this point, near the footwall formation.

Sierra Nevada—The directors of this company, upon recommendation of Superintendent Julihn, have decided to start a northeast drift at once, from the west crosscut on the 2500 station of the joint winze. The drift will follow along the course of fracture into Sierra Nevada ground, assays secured from the formation being high enough to warrant this new exploration work.

Mexican—Five bars of bullion, shipped from the mill, netted the company $12,065, and the returns from the cleanup at the end of February are expected to increase the income from the mill for that month to at least $25,000. The mine and mill expense for the same period is approximately $15,000, showing a net profit of $10,000 for the month.

Crown Point—A run of 3500 tons of low-grade ore has been completed at the Yellow Jacket mill, and gave about 45 tons of concentrate, which were shipped to the smeltery. A preliminary estimate of the returns is between $20,000 and $30,000. The Yellow Jacket mill is now treating ore from the Jacket surface dumps.

Nye County

Tonopah Extension—The monthly report states that during February the mill treated 3822 tons of ore of a gross value of $51,583. The western workings of the mine on the 500-ft. level are showing up large bodies of ore averaging $20 per ton.

Montana-Tonopah—During February the mill produced bullion worth $29,821, and 62 tons of concentrates. A shoot of high-grade ore has been opened at a depth of 350 ft. and indicated for a length of 140 ft.; it is from 5 to 15 ft. wide. A new vein 3 ft. wide has also been cut on the 665-ft. level.

MacNamara—The new mill is now treating 60 tons of $15 ore per day. It is thought that the capacity of the mill can be worked up to 70 tons per day.

Tonopah-Halifax—The shaft, which is being sunk to intercept the extension of the Belmont vein, is now 930 ft. deep and is cutting stringers of low-grade quartz.

West End—The mill is treating about 800 tons of ore per week, and in addi-

tion, the company is shipping 40 tons of ore, averaging from $50 to $60 per ton, to the smeltery every week. The main stope on the 500-ft. level shows the vein to be 19 ft. wide, all of which is mined.

New Mexico

Romero—This company is developing some tungsten deposits in the El Porvenir district, 18 miles northeast of Las Vegas. The ore carries gold and silver. A shaft is down 65 ft. and an adit on the vein is in 310 ft. A concentrator is being erected. The officers are M. Romero, president; Dr. J. M. Cunningham, treasurer; H. C. De Baca, secretary.

Socorro—The new power plant is furnishing power for both mine and mill and the full force is at work in the mines.

Ernestine—During a recent week 640 tons were treated in the mill. The second 10-day cleanup in February amounted to 7675 oz. of gold and silver bullion and 1100 lb. of concentrates. The second battery of 10 Allis-Chalmers stamps was placed in commission on Feb. 26.

Deep Down—The leasers have installed a temporary pump in the tunnel to keep water out of the winze now being sunk. Specimen ore is found occasionally.

Oaks—The winze in the tunnel on the Pacific lode has encountered small quantities of high-grade ore. The south shaft continues sinking and a drift is being run from the north shaft.

Oregon

J. W. Morgan, of Portland, contemplates the erection of a concentrating plant for his property near Gold Hill, Jackson County.

Braden—This property near Gold Hill, in Jackson County, has been leased by J. W. Opp, who will improve it.

Sterling Quartz—This mine in Jackson County has been leased by R. L. Bar. The mine is already equipped with some machinery, and it is the intention to start operations.

Utah

Beaver County

Majestic—Silver-lead ore of shipping grade is being mined from the west drift in the Harrington-Hickory. Three cars were shipped recently.

Indian Queen—Leasers are making occasional shipments from the upper levels.

Summit Mining—The property of this company, recently organized, consists of five claims adjoining the Black Bird on the east, and 2½ miles north of the Horn Silver. The claims were formerly worked by the Francisco Mining Co. Leasers are reported recently to have mined 70 sacks of good ore in two months. Development on company account will probably be undertaken in the summer.

King of the Hills—Considerable work has been done on this property in the past and several shipments of from 6 to 7% copper ore made. During the present winter development at deeper levels was undertaken with encouraging results. A strike of 5 ft. of copper ore of good quality is reported on the 240-ft. level.

Juab County

Tintic shipments for the week ended Mar. 1 were 187 cars.

Beck Tunnel—Shipping ore has been opened in a raise from the 175-ft. level of the No. 2 shaft. When the company's indebtedness, half of which has been cleared off, is entirely liquidated, it is the intention to drive below the 1100-ft. level.

Eagle & Blue Bell—The shaft, which is being driven to connect the 1000- and 1400-ft. levels, is below the 1200. During February, about 1000 tons of ore were shipped from the 1200- and 1300-ft. levels. A car of shipping ore from the 700-ft. level is ready for the market and the orebody here is reported to be opening satisfactorily. The report for the year ended Dec. 31, 1911, shows a total production of 5831 tons of ore, gross value being $109,962; smeltery returns, $61,017. The ore yielded: Gold, 1995 oz.; silver, 98,738 oz.; lead, 726,796 lb.; copper, 9747 lb. In development, the report states, that the policy of "staying with the ore" was strictly adhered to and rigid economy was exercised. The year closed with $21,241, net operating profit.

Opohongo—About four cars per week are being shipped from the levels above the 700. On the latter level a raise will be driven at a point where gold ore has been opened. Crosscutting to the east is being done on the 1000 level, in order to connect with ore found some time ago through the Black Jack workings.

Gold Chain—Ten cars were shipped the week ended Mar. 1, most of the ore coming from above the 700-ft. level. Work at greater depth, however, is planned, and a winze from the 700 is being sunk in ore.

Tintic Standard—Two drifts, 100 ft. apart, are being driven northeast on the 1000-ft. level.

Grand Central—The shaft is down 2325 ft., and a station will be cut on the 2300. When this work, which will take about three months, is completed, a drift will be driven under the orebody on the 2200. The average weekly shipments since Jan. 1 have been nine cars.

Swansea—Shipments from the recent discovery on the 940-ft. level ran 20 oz. silver and 28 to 30% iron, and this appears to be the average grade. It is stated by one of the officials that the company will make about $8 per ton from this ore. Three cars were shipped during the week ended Mar. 1.

Iron King—A report to stockholders has been issued. During 1911 and up to the time of closing the mine in February, 1912, the main work has been that of developing and opening the orebodies. The report gives 100,000 tons as a conservative estimate of the iron ore blocked out. In closing down, the idea of the probable existence of precious metals under the large iron bodies has not been abandoned, and the management hopes at some future time, when the sale of iron will meet the expense, to go deeper in search of these metals. Receipts for the period from Jan. 1, 1911, to February, 1912, were $25,685, and disbursements, $29,950. In closing down it is thought necessary to meet all obligations of the company, and the money raised by assessment No. 6 will meet these and leave a small working capital.

Salt Lake County

Utah Apex—Net profits for January were $31,993. The total gross value of the ore shipped during the month was $69,416; $5407 came from gold, $15,704 from silver and $48,303 from lead. Smelting and freight charges were $16,538, and mining, milling and development costs were $20,884.

Montana-Bingham—The 4000-ft. drain and development tunnel is in 510 ft., and progressing at the rate of 4 ft. per day. It will cut the Quinn fissure and several other fissures in Montana-Bingham ground, and will reach the Bingham Amalgamated lines with 3200 ft. of work. The face is in quartzite and porphyry, showing mineralization.

Dalton & Lark—The report for the year ended Dec. 31, 1911, shows a total production from the Lead Mine vein of 13,759 tons, bringing smeltery returns, after deducting freight and treatment, of $136,828. The Lark vein produced 3368 tons of lead and copper ore, bringing net smeltery returns of $56,234. The Commercial mine, also owned by the Bingham Mines Co., shipped no ore until April, and was shut down in September. About 110 tons per day are now being shipped. Development work totaled 1928 ft. and cost $6.68 per foot.

Washington

Germania Tungsten—Efforts are being made by William Scheck, Springdale, to reopen these tungsten mines in the Deer Trail district, Stevens County. It is the intention to enlarge operations.

Vance—This company has been organized for the purpose of developing a group of claims near Leavenworth, Chelan County. Albert Van Epps is general manager. Active operations will be started soon.

Canada

BRITISH COLUMBIA

Shipments and receipts in tons in the Boundary district for the week ended Feb. 29 were as follows:

Mine	Week	Year to Date
Granby	23,515	194,412
Mother Lode	6,532	68,305
Rawhide	4,810	12,344
Jack Pot	329	3,177
Athelstan	89	340
Emma	436	4,465
Others	493	1,937
Totals	36,204	284,980
Smelteries		
Granby	23,875	238,470
B. C. Copper Co	12,872	91,999
Totals	36.747	330,469

ONTARIO

Brandon Oil Syndicate—The first pumping at the well, recently put down at Milton, was done Mar. 6, and nine barrels were filled at the rate of four per hour. Ten 1400-gal. tanks have arrived and are being filled. The well will be emptied as fast as possible, and drilled 35 ft. deeper and shot.

ONTARIO—COBALT

Cobalt shipments for the week ended Mar. 8, were: La Rose, 145,400 lb.; Kerr Lake, 131,440; Temiskaming, 84,880; Wettlaufer, 65,140; Hudson Bay, 62,340; McKinley-Darragh, 60,640; Buffalo, 58,680; Coniagas, 58,300; Cobalt Townsite, 58,000; Trethewey, 40,960; Crown Reserve, 39,780; total, 871,420 lb. Bullion shipments were: Nipissing, 22,687 oz.; O'Brien, 10,262; Trethewey, 2024; Crown Reserve, 18,390; total, 53,633 ounces.

Beaver—This company has just completed a concentrating mill of 50-tons daily capacity, the especially interesting feature of which is the system of jigging the product from a gyratory crusher and regrinding the tailings by Hardinge ball and pebble mills, one of each, and finally washing on James tables.

Casey-Cobalt—At a meeting in London, Eng., a resolution was adopted authorizing the increase of the capital from £200,000 to £250,000. It is proposed to install a new compressor, to secure power from one of the Cobalt electric companies and to put up a concentrator of 12½ tons daily capacity.

Nipissing—The output for last month was $226,419, net produced, and $545,559 shipped, which is probably the largest amount sent out by any Cobalt mine in one month.

Hargrave—The report shows a total production during 1911 of 113,000 oz. of silver, worth over $58,000, and expenses amounting to $59,418; in addition to $10,478 expended in the purchase of a Porcupine claim. The cash balance on hand, Dec. 31, was $22,954, and $37,260 ore on hand and at smelteries.

McKinley-Darragh—This company, by declaring a 10% dividend, payable Apr. 1, has amortized its capitalization, bringing the returns to shareholders up to a total of 106 per cent.

ONTARIO—PORCUPINE

The extension of the railway from South Porcupine to Timmins, five miles, has been opened for passenger traffic.

There are three mills in the district under construction, viz., the Hollinger, 40 stamps, the Dome, 40 stamps, and the Vipond, four Hardinge conical mills. The McIntyre mill, 10 stamps, has been put in operation. Remarkable feats have been done in the construction of these mills during a severe winter.

New York men are considering the erection of a customs mill at Swastika, to treat the ore from the Lucky Cross and Swastika mines, provided satisfactory arrangements can be made with the directors of these companies.

United Porcupine—The shareholders have authorized the directors to borrow $25,000 to carry on development work.

Rea—The 400-ft. level has been reached and crosscutting to pick up the vein will be undertaken immediately. This is expected to be reached at a distance of 45 ft. The vein widened from 4 ft. of $20 ore at the upper levels to 32 ft. at the 300-ft. level, but carried less gold at the latter depth.

Swastika—The report for the year 1911 shows that the company is about out of funds. The mine has 10,000 tons of $12 ore blocked out. It is understood that New York men are interested in the property and that they may furnish the money to finance the mine until it reaches the stage of production; $80,000 is to be advanced.

Vipond—Recent development on the No. 2 vein has opened another shoot of high-grade ore.

West Dome—This company is short of money, but it is understood that inside interests have taken up a sufficient block of the treasury stock to provide capital.

Porcupine United—The shareholders have authorized the directors to raise $25,000 to carry on the development work.

McEnaney—This property is showing up well under development.

Hollinger—The mill building has been completed and the foundations for the stamps are laid, but relatively little of the machinery has yet been set. The mill will probably be ready to begin operating before summer.

Dome—The mill is practically completed and probably will be put in operation before May.

ONTARIO—SUDBURY

Development work on one or two claims in the Wahnapitae gold district, has shown up some promising ore, and it is quite possible that more of the old claims would show up pay ore if a reasonable amount of work were done on them. All past efforts to make a paying mine in this district have failed.

Alexo—This nickel claim, owned by Alexander Kelso, and situated near Kelso, on the Temiskaming & Northern Ontario Ry., is being developed by the owner and associates.

Mexico

AGUASCALIENTES

Dispatches state that operations of the American Smelting & Refining Co. have not been interfered with. Train service has been interrupted at certain points, and the smeltery at Aguascalientes has been unable to receive ore from the north. Should the San Luis division of the National Railways of Mexico be put out of commission, the smeltery would only be able to run for a week or 10 days. That the San Luis division will be put out of commission is expected at any time.

CHIHUAHUA

Rio Plata—The fourth annual report shows: Total earnings, $410,996; expenses, $194,049; net profit, $216,946. After deducting dividends paid, $192,139 remained as earned surplus on Nov. 30, 1911, the end of the fiscal year.

MEXICO

El Oro—During February the mill crushed 22,900 tons of ore yielding bullion worth $161,180. Working expenses were $92,220; development, $18,280; total profit from mine and railway, $63,820; permanent improvement, $6960.

OAXACA

Natividad—A serious fire is reported to have occurred on Feb. 26. The fire originated in the deserted upper levels and 10 men are stated to have been killed.

Africa

TRANSVAAL

Gold production in the Transvaal in February was 703,866 oz., or $14,548,910. This is 33,194 oz. less than in January, but the decrease was due entirely to the shorter month, the daily average being 23,776 oz. in January and 24,271 oz. in February. For the two months ended Feb. 29, the total was 1,261,855 oz. in 1911, and 1,440,926 oz.—or $29,783,940—in 1912; an increase of 179,071 oz., or 14.2%, this year.

Asia

CHOSEN

Oriental—The cleanup for February was $125,200. During January, 25,840 tons were crushed. Total bullion receipts were $127,472; lack of cordwood continued to necessitate only partial operations.

The Market Report

Current Prices of the Metals, Minerals, Coal and Mining Stocks

Coal Trade Review

New York, Mar. 13—The coal trade seems to be generally uncertain and wholly at the mercy of "wars and rumors of wars"—strikes in England and Germany and possible strikes here. The other important factor is in the railroads. There is a great demand for coal, but the railroads do not respond. Short car supply and slow transportation are the rule everywhere, though the railroads are showing some improvements. There is a widespread desire to stock coal, in addition to the current demand; but there is much difficulty in meeting these calls. The coal can be mined, but it does not seem possible to get it moved with any degree of promptness.

There are reports of large orders for export, though it is difficult to trace them with any certainty. If any have been placed—and some probably have—dealers do not know just when they can be filled. The demand for bunker coal on the Atlantic seaboard is exceedingly heavy.

The anthracite mine operators' committee meets the miners' representatives in New York today, with a refusal of all the demands presented at the last conference. There is no opening for discussion; but there is an opportunity for the presentation of new conditions later. The whole situation seems to hinge on the anthracite position, and probably nothing will be done in the West until there is some settlement in the East—or a strike.

Anthracite shipments in February were 5,875,968 long tons, being 112,272 tons more than in January, and 805,020 tons more than in February, 1911. They were the largest ever reported in February. For the two months ended Feb. 29, the shipments were 10,970,065 tons in 1911, and 11,639,664 in 1912; an increase of 664,599 tons, or 6.1% this year.

Coal and coke carried on Pennsylvania R.R. lines east of Pittsburg and Erie, month of January, short tons:

	1911	1912	Changes	
Anthracite	1,101,192	1,040,535	D.	60,657
Bituminous	3,621,472	3,581,365	D.	40,107
Coke	847,140	940,931	I.	93,791
Total	5,569,804	5,562,831	D.	6,972

The total decrease was 0.1% this year, coke alone showing a gain.

Bunker coal supplied to steamships in New York harbor in 1911 was: Steamers in foreign trade, 3,796,022; coastwise, 937,809; total, 4,733,831 tons. This is an increase of 48,985 tons, or 1 per cent., over the previous year.

Coastwise shipments of coal from leading Atlantic ports year ended Dec. 31, long tons:

	Anthracite	Bituminous	Total
New York	14,651,401	10,749,988	25,401,386
Philadelphia	2,197,750	4,856,626	7,054,376
Baltimore	257,025	4,002,809	4,259,834
Newport News	.....	2,678,156	2,678,156
Norfolk	.....	4,698,769	4,698,769
Total	17,106,176	26,986,348	44,092,524
Total, 1910	16,243,378	25,835,029	42,078,407

Total increase in 1911 over 1910 was 2,014,117 tons, or 4.8%. New York covers all the harbor shipping points, and includes coal for city and other neighboring wharves.

Iron Trade Review

New York, Mar. 13—Business in iron and steel continues generally active. New orders and specifications on contracts keep the mills in good shape as far as work is concerned. Perhaps the strongest point just now is in structural steel, as many new orders for spring work are coming in, both for large and small quantities. The demand for steel has brought about the placing of some considerable orders for bessemer and basic pig with the merchant furnaces.

Besides these pig iron orders, a number of contracts for foundry iron are reported, especially in Eastern territory. Prices of pig iron have not actually advanced, but there is a general firming up and sellers are not inclined to make concessions.

There are indications of increased interest in Lake ore, and some sales direct to furnaces are reported, but no prices have yet been fixed. The sales have been mainly by companies which have stocks on hand from last season.

In order to further the interests of steel mills making bars for reinforcing concrete, the Rail Steel Bar Manufacturers' Association has been organized. These officers have been elected: President E. E. Hughes, Franklin, Penn.; vice-president, J. G. Joseph, Buffalo, N. Y.; secretary-treasurer, A. S. Hook, Chicago.

The unfinished orders on the books of the United States Steel Corporation, on Feb. 29, were 5,454,200 tons. This is an increase of 74,479 tons over Jan. 31, and is the largest total reported since Dec. 31, 1909. The gain in February indicates that new orders exceeded shipments.

Pig-Iron Production—The reports of the blast furnaces, as collected and published by the *Iron Age*, show that on Mar. 1 there were 234 coke and anthracite furnaces in blast, having a total daily capacity of 73,650 tons, an increase of 2550 tons over Feb. 1. Making allowance for the charcoal furnaces, the total production of pig iron in the United States in February was 2,120,400 tons; for the two months ended Feb. 29, it was 4,197,900 tons.

Baltimore

March 11—Exports for the week included 2,764,720 lb. steel billets to Liverpool; 657,200 lb. galvanized steel pipe to Rotterdam. Imports included 101 tons spiegeleisen, 1427 tons ferromanganese and 75 cases silicospiegel from Liverpool; 5340 tons manganese ore from Batum, Russia.

Birmingham

March 11—There continue to be small sales, mostly at the basis of $10.50 for No. 2 foundry. There are some large inquiries, it is stated, but these buyers generally want concessions which the makers are not willing to grant. Very little second-half business has been closed yet, at any price.

Cast-iron pipe plants are very busy, and there is an actual scarcity of the lower grades of foundry iron.

Scrap business is quiet and dealers are not pushing sales, as they look for better prices.

Chicago

Mar. 11—There is no marked change in the market for pig iron. Sales continue to be of the small-tonnage, short-time delivery kind, with every founder looking closely to future developments and figuring on prospective changes in market conditions. There are some fair inquiries, which may develop good-sized contracts in the coming week, but they are probably intended to test the market rather than to develop actual orders.

Northern iron holds to $14 furnace, and is very firm. Southern is between $10 and $10.50 Birmingham, with the selling agents trying hard to hold the price to the higher quotation, but rumor saying that the price is cut by at least 25c. on any order of importance. The $10.50, Birmingham, price means $14.85, Chicago.

Sales of pig iron run from a carload up to 500 or 600 tons. The aggregate is not large, but compares favorably with the aggregate tonnage of any week in

the last two or three months. It is still a waiting, quiet market.

In iron and steel products the tendency is upward. Structural material has had a good sale in the last week, bridge and building requirements increasing. Prices are unchanged, beams and channels under 15 in. selling for 1.28@1.33c. Bars are stronger, with local mills busy and no price cutting, though the total of sales is not heavy. Soft steel bars bring 1.25@1.33c., base, and bar iron holds to 1.50@1.60c., base. Billets are quiet at $26.50 for openhearth forging. Plates are in good demand at unchanged prices, and sheets also hold up fairly well, the price of No. 28 black being 2.03c. minimum. Railroad supplies are still in light demand generally. Wire products are selling rather lightly yet, but prospects are for a heavy business soon. Coke sales, as an indication of the iron market, are encouraging.

Cleveland

Mar. 11—Some scattering ore sales are reported, but no further movement to fix prices.

Pig Iron—The market remains quiet, but there are a good many inquiries. The Algoma company at the Sault is reported to be in the market for 50,000 tons of bessemer and basic, deliveries to run over some time. Prices are unchanged.

Finished Material—Business is generally active and hopeful, large orders being in sight. Prices are inclined to be firmer than for some time past.

Philadelphia

Mar. 13—The possibilities of an anthracite and bituminous strike, especially the former, are causing some uneasiness. The stock of coke at Eastern furnaces is large and is being increased against possible emergencies. Basic has advanced and large purchases are said to be in sight for forward delivery. Low-grade iron has further advanced and extensive purchases have been concluded within a week and other purchases are now pending. Today's rumors indicate favorable possibilities of sales abroad which will probably be secured by Southern furnaces. Both favorable and unfavorable influences are at work in the pig-iron market but the run of ordinary buyers are taking no special interest outside of supplying their needs for a few weeks in advance. Quotations are close to $15 for No. 2 X foundry with very little difference in Southern makes. Gray forge is $14.25, basic $14.25 and low phosphorus is $19 per ton.

Steel Billets—Openhearth rolling billets are quoted $22.40@23.40 without large sales, though the inquiries denote business at an early day if offers are accepted. Forging billets sell in small lots for immediate needs.

Bars—Some mill owners report an increase in car orders for common bars while others are picking up only the usual run of small orders. Steel bars are strong without much additional business.

Sheets—Sheets have advanced slightly for early deliveries, with inquiries enough to give confidence as to continued activity.

Pipes and Tubes—Pipe makers report quite an improvement in inquiry in all lines and tube mills have secured some important business from this territory; and discounts are firmly maintained.

Plates—A large amount of business is in sight from the shipyards. The outlook for plates has considerably improved. Contracts have virtually been placed by a European government for two large vessels with a local shipyard.

Structural Material—The interest in the market at present is due to prospective business of large proportions. Local construction requirements are also looming up.

Scrap—The market has begun to show signs of activity. Satisfactory purchases have been made by a number of buyers for considerable quantities and shipments will be made immediately.

Pittsburg

Mar. 12—The feature of the week has been the heavy movement in steel-making irons, fully 175,000 tons of bessemer and basic having been sold within the past 10 days. The bessemer iron purchases have not advanced the market, but they have served to emphasize the fact that the steel mills are busy and have greatly improved the statistical position of pig iron. The basic iron purchases have actually advanced the market, making it quotable at fully 50c. above the level prevailing at the close of January, the major part of February being dull, with no closely quotable market.

The finished-steel trade gives better reports as to demand and firmness in price, but the improvement is barely noticeable and is not as great as should reasonably be expected at this season, when an unprecedentedly hard winter is giving way to spring, and when there should be a rush to get material if buyers have not already been taking heavier deliveries than they needed. The prospect is that the present level of finished-steel prices will be maintained, with perhaps slight advances, but there does not appear to be much prospect of a restoration of prices. A point of importance is that there is little new buying this month, when it was reported in November and December that many of the contracts then entered were for first-quarter delivery only. If those reports were all true, a fresh buying movement should certainly be in progress by this time. It seems quite clear that the output of the mills has been sold up fairly well to July 1 at the low prices and that consumers will not need to enter the market afresh in a large way unless their consumptive requirements prove larger than they anticipated.

The increase of 74,479 tons during February in the United States Steel Corporation's unfilled tonnage is in line with the later predictions, though not with those made up to the middle of the month, when it was expected that the corporation would break even or else show an actual loss. Evidently the gain was made entirely in the second half of the month.

Pig Iron—Sales in the past 10 days include 10,000 tons of Valley basic to the Jones & Laughlin Steel Co. at $12.40, Valley, already reported, the closing up of the warrant iron at Midland, held speculatively under warrant, about 50,000 tons, 5000 tons of Valley basic to the Gould Coupler Co. at $12.60, Valley, and 1000 tons to another interest at $12.75, Valley, at which last price the market is quotable, furnaces asking $13. Bessemer sales include 20,000 tons taken by the Steel Corporation at $14, Valley, half from a Sharpsville and half from a Youngstown producer, 25,000 tons taken from a Sharpsville furnace by the Youngstown Sheet & Tube Co., with freight equalized with $14 at Youngstown district furnace, 55,000 tons taken from a Lowellville furnace by the same interest at $14, furnace, 100,000 tons of ore being given in partial payment, and 10,000 tons purchased by the Republic Iron & Steel Co. at $14, Brier Hill furnace. Foundry iron continues quiet, but furnaces are still more frequently obtaining $13.25, Valley, on the small lots they sell. We quote: Bessemer, $14; basic, $12.75@13; malleable, $12.75@13; No. 2 foundry, $13@13.25; gray forge, $12.75@12.85, all f.o.b. Valley furnaces, 90c. higher delivered Pittsburg.

Ferromanganese—The market continues quiet, with prompt and forward quoted at $41, Baltimore.

Steel—The Youngstown Sheet & Tube Co. has sold the Brier Hill Steel Co. 25,000 tons of sheet bars, and several other sales have been made in that district, making the market firmer, at $19.25@19.50 for bessemer billets and $20 for bessemer sheet bars, f.o.b. maker's mill, Youngstown. At Pittsburg the market has been well sold up and prices continue firm, at $19.50@20 for bessemer billets and $19.25@19.50 for openhearth billets, with openhearth sheet bars about $20.50, f.o.b. maker's mill, Pittsburg. There is really no close quotation on bessemer sheet bars at Pittsburg. Rods are $25, Pittsburg, and very quiet. Mills are behind in deliveries on contract in both billets and sheet bars.

Sheets—The market continues irregular, but is perhaps a trifle firmer, owing to the withdrawal of a few particularly

low quotations. Specifications are excellent, and several large mills are not only comfortably filled for the present but can see a continuance of present operations for weeks to come without the advent of much new business. We quote black sheets at 1.80c., galvanized at 2.80c. and blue annealed at 1.35c. The price on black is occasionally shaded.

St. Louis

Mar. 11—The market is about the same, though the threatened coal strike is a weight upon trade. Agents have tried hard to get an additional 25c. on Southern iron, but the current price on Southern No. 2 foundry iron remains $10@10.25, Birmingham, or $13.75@14, St. Louis. No. 2 Northern foundry is quoted at $14.25@14.75 per ton.

Coke is in poor supply now, and foundry coke is selling at $5.10@5.20 per ton, St. Louis.

United States Foreign Trade

Exports and imports of iron and steel and of machinery in the United States for the month of January, are valued as below by the Bureau of Statistics of the Department of Commerce and Labor:

	1911	1912	Changes
Exports	$18,738,391	$18,451,914	D. $286,477
Imports	2,874,740	2,404,702	D. 470,038
Excess, exp.	$15,863,651	$16,047,212	I. $183,561

Decrease in exports, 1.5%; in imports, 16.4%. The leading articles of iron and steel were, in long tons:

	Exports 1911	Exports 1912	Imports 1911	Imports 1912
Pig iron	10,798	8,663	19,177	13,085
Scrap	5,116	7,501	303	624
Billets, blooms, etc.	11,731	12,779	2,865	1,392
Bars	8,842	12,180	2,601	2,055
Rails	43,127	24,445	....	335
Sheets and plates	21,234	30,054	292	265
Structural steel	12,152	13,647	.....	35
Wire-rods	475	3,272	2,156	1,760
Wire	15,322	15,586	.....	.....
Nails and spikes	6,184	3,237	.....	.....
Tinplates	2,857	4,076	5,677	267
Pipe and fittings	1,431	1,597	.....	.....

Imports of wire are not reported in quantities; values were $124,172 in 1911, and $93,833 in 1912. Exports of mining machinery were valued at $420,773; a decrease of $264,679, or 38.6%, from last year.

Iron Ore Trade

Rail shipments of Lake Superior ore in 1912, as finally adjusted, were 662,719 tons, making the total shipments for the year, 32,793,130 tons; a decrease of 10,649,267 tons, or 24.5%, as compared with 1910. Particulars of the shipments are given elsewhere.

German Iron Ore—Imports of iron ore in Germany for the year ended Dec. 31 were 10,812,595 metric tons, an increase of 995,773 tons over 1910; exports, 2,581,698 tons, a decrease of 370,934 tons. Imports of manganese ore in 1911 were 420,709 tons, a decrease of 67,163 tons; exports, 9615 tons, an increase of 5056 tons.

Metal Markets

New York, March 13—The metal markets show no special change during the week. Business has generally been quiet.

MONTHLY INDEX NUMBERS

Month	1911	1912	Month	1911	1912
January	110	111	July	112	.....
February	115	109	August	117	.....
March	112	.....	September	111	.....
April	114	.....	October	112	.....
May	118	.....	November	111	.....
June	115	.....	December	110	.....

Year 1909, 115; 1910, 115; 1911, 112.
Numbers for each month and year calculated on approximate sales of pig iron, copper, tin, lead, zinc and aluminum.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal	Exports	Imports	Excess
Gold			
Jan. 1912	$ 1,915,202	$ 5,165,543	Imp. $3,250,341
" 1911	923,676	9,540,830	Imp. 8,617,154
Year 1912	1,915,202	5,165,543	Imp. 3,250,341
" 1911	923,676	9,540,830	Imp. 8,617,154
Silver			
Jan. 1912	6,027,905	4,358,009	Exp. 1,669,896
" 1911	5,651,076	3,551,426	Exp. 2,099,650
Year 1912	6,027,905	4,358,009	Exp. 1,669,896
" 1911	5,651,076	3,551,426	Exp. 2,099,650

Exports from the port of New York, week ended March 9: Gold, $5,294,800, chiefly to Argentina; silver, $1,087,291, principally to London. Imports: Gold, $816,754; silver, $209,476, from Mexico and South America.

Gold—The price of gold on the open market in London was unchanged at 77s. 9d. per oz. for American coin. An increased amount was taken for India. In New York more gold was taken for Argentina.

Platinum—The market remains quiet, with no change in prices. We continue to quote $45.50 per oz. for refined platinum and $48 per oz. for hard metal.

Through an error in transcribing, the imports of platinum in January were given erroneously in the table published last week. The actual imports for the month were 5926 oz. in 1911, and 8215 oz. this year.

Silver—The tendency of silver is toward steadiness at current rates. The best advices indicate that no great fluctuations in price are expected at present.

Exports of silver from London to the East, Jan. 1 to Feb. 22, reported by Messrs. Pixley & Abell:

	1911	1912	Changes
India	£1,793,200	£1,291,300	D. £501,900
China	602,800	400,000	D. 202,800
Total	£2,396,000	£1,691,300	D. £704,700

SILVER AND STERLING EXCHANGE

Mar.	7	8	9	11	12	13
New York	58¾	58¼	58¼	58⅛	58⅝	58⅛
London	26⅞	26⅛	26⅛	26⅛	27	26⅛
Sterling Ex.	4.8715	4.8715	4.8720	4.8720	4.8725	4.8720

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper, Tin, Lead and Zinc

NEW YORK

Mar.	Copper Lake, Cts. per lb.	Copper Electrolytic, Cts. per lb.	Tin Cts. per lb.	Lead New York, Cts. per lb.	Lead St. Louis, Cts. per lb.	Zinc New York, Cts. per lb.	Zinc St. Louis, Cts. per lb.
7	14⅛ @14¾	14.40 @14.45	42¾	4.00	3.92½ @3.97½	6.60 @6.90	6.45 @6.75
8	14⅛ @14¾	14.40 @14.45	42⅛	4.00	3.92½ @3.97½	6.60 @6.90	6.45 @6.75
9	14⅛ @14¾	14.40 @14.45	42⅛	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
11	14⅛ @14¾	14.40 @14.45	42⅞	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
12	14⅛ @14¾	14.40 @14.45	42⅛	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80
13	14⅛ @14¾	14.40 @14.45	41⅞	4.00	3.92½ @3.97½	6.65 @6.95	6.50 @6.80

The quotations for copper, lead, spelter and tin are for wholesale contracts with cunsumers, without distinction as to deliveries; and are representative, as nearly as possible, of the bulk of the transactions, reduced to basis of New York, cash, except where St. Louis is specified as the basing point. The quotations for electrolytic copper are for cakes, ingots and wirebars. The price of electrolytic cathodes is usually 0.05 to 0.10c. and that for casting copper usually about 0.125 to 0.2c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market for good ordinary brands, both desilverized and non-desilverized; specially refined corroding lead commands a premium. The quotations on spelter are for ordinary Western brands; special brands command a premium.

LONDON

Mar.	Copper Spot	Copper 3 Mos	Copper Best Sel'td	Tin Spot	Tin 3 Mos	Lead, Spanish	Zinc, Ordinaries
7	64¾	65½	69	192¼	188¼	15 13/16	26½
8	64 11/16	65 7/16	69	190	186¼	15 13/16	26½
9	.....	.....	.....	.....	.....	.....	.....
11	64 7/16	65 3/16	68¾	192¾	187½	15 13/16	26½
12	64 9/16	65¼	68¾	192	187½	15⅞	26½
13	65 1/16	65 11/16	69	189¼	186¼	15⅞	26½

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb. Copper quotations are for standard copper, spot and three months, and for best selected, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given: £10 = 2.17½c; £12 = 2.61c.; £23 = 5c.; £60 = 13.04c. ± £1 = ± 0.21¾c.

Copper—During the last week the market has been dull and uninteresting, sales having been small in volume. Most of the large sellers of electrolytic have been holding firmly at 14.60@14.62½, delivered, usual terms, but there has been some shading by second hands, especially during the last two or three days, and what little business was placed must have been secured by them; but its amount has been too small to affect the general position. Some moderate sales of Lake copper at 14½@14⅝c. have been reported, with 14¾c. continuing to be the price asked by the leading seller for its

premier brand. The undertone of the market remains strong, sellers regarding the outlook encouraging for a more active business, due to the favorable reports regarding an early settlement of the English coal strike. The close is steady at 14½@14¾c. for Lake; 14.40@14.45c. for electrolytic in cakes, wirebars or ingots, while casting copper is quoted nominally at 14.20@14.25 cents.

The London standard market was reactionary up to Mar. 11, when prices touched £64 8s. 9d. for spot and £65 3s. 9d. for three months. Since then, there has been a decided improvement, and the close is firm at £65 1s. 3d. for spot and £65 16s. 3d. for three months prompt.

Copper sheets are 19@20c. base for large lots. Full extras are charged and higher prices for small quantities. Copper wire is 15½c. base, carload lots at mill.

Copper exports from New York for the week were 6113 long tons. Our special correspondent gives the exports from Baltimore at 3398 tons.

Brass Prices—The following list prices took effect Mar. 1: Sheets, high brass, 15¾c. net per lb.; low brass, 17¼c. Rods, high brass, 15½c.; low brass, 18c. Tubing, brazed, 20½c.; open seam, 19⅛c. Brass angles and channels, 19½c. Scrap allowances are 10¼c. net per lb. for high brass and 11¼c. for low brass.

Tin—The London market was somewhat affected by the English coal strike, a fear having been expressed of unfavorable statistics, due to smaller deliveries. It grew steadier as an early settlement of the strike became apparent, but closes rather weak at £189 5s. for spot and £186 5s. for three months.

Considerable business was done in this market, due to a good demand from the tinplate manufacturers. However, the declining tendency of the London market during the first half of this week tended to make buyers more reluctant, and they are now holding back pending further developments. At the close, March tin can be purchased at about 41⅞ cents.

Tin shipments from the Straits in February are reported at 5260 long tons, an increase of 970 tons over February of last year.

Visible stocks of tin, on Feb. 29, are reported as follows: London, 9351; Holland, 543; United States, excluding Pacific ports, 5102; total, 14,996 long tons, a decrease of 1711 tons from the Jan. 31 report.

Lead—The market is unchanged at 4c., New York, and 3.92½@3.97½c., St. Louis.

The London market is very firm, and some nervousness is being shown on account of the decrease in lead shipments from Mexico, as there is no way of determining when the movement of lead from that country will be resumed from the districts which are now affected. The close is firm at £15 17s. 6d. for Spanish lead and 2s. 6d. more for English.

Spelter—There has been an active demand for future deliveries and some rather large sales have been reported at about 6.50c., St. Louis. For near-by deliveries the situation is uncertain. Some sellers report a fair demand; others the reverse. The market is very irregular, widely different prices being accepted for similar deliveries. Metal for prompt shipment continues to fetch a premium, but this is realized on but relatively small quantities. Some fair tonnages offered at 6.80c., St. Louis, failed to find buyers, but that price has been paid for carload lots. It would appear, that the demand for near-by spelter is on the decrease and that all urgent wants have been fairly covered. The close is firm at 6.65@6.95c. New York and 6.50@6.80c. St. Louis.

The London market is unchanged at £26 10s. for good ordinaries and £26 15s. for specials.

Zinc dust is quoted at 7⅛@7¼c. per lb., New York.

Base price of zinc sheets was advanced ¼c. per lb. on Mar. 7, and is now $8.50 per 100 lb., f.o.b. La Salle-Peru, Ill., less 8% discount.

Other Metals

Aluminum—The market is fairly active and prices are firmer, but without quotable change. Current price is 19¼@19½c. for No. 1 ingots, New York.

Antimony—Business has shown little change and prices remain about the same. Cookson's is 7¼@7⅜c. per lb., Hallett's is 7⅜@7½c., while 6¾@6⅞c. per lb. is asked for Chinese, Hungarian and other outside brands.

Quicksilver—The market is a little firmer, and prices are unchanged. The New York quotation is $46 per flask of 75 lb., with the usual advances for small quantities. San Francisco, $45 for domestic orders and $42.50 for export. The London price is £8 7s. 6d. per flask, while £8 2s. 6d. is quoted from second hands.

Bismuth—The syndicate which controls the European production quotes 7s. 6d.—equal to $1.80—per lb. in London. In New York a quotation of $1.72 per lb. is made for metal produced from American ores.

Cadmium—The latest quotation received is 700 marks per 100 kg., f.o.b. works in Silesia, Germany. This is equal to 75.6c. per lb., at works.

Magnesium—The price of pure metal is $1.50 per lb. for 100-lb. lots, f.o.b. New York.

Nickel—Large lots, contract business, 40@45c. per lb. Retail spot from 50c. for 500-lb. lots up to 55c. for 200-lb. lots. The price of electrolytic is 5c. higher.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 9—The base price paid this week for 60% zinc ore was $49@53. The highest price paid for zinc ore was $55. The base price for 80% lead ore was $49 per ton.

SHIPMENTS, WEEK ENDED MAR. 9

Camps	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Shullsburg	1,048,580	.....	.....
Benton	713,200	.....	225,900
Galena	702,600	.....	.....
Mineral Point	671,800	.....	.....
Hazel Green	566,600	.....	.....
Platteville	330,000	.....	88,000
Cuba City	143,700	88,390	63,750
Rewey	83,000	.....	.....
Montfort	82,000	.....	.....
Linden	80,000	.....	295,330
Harker	64,590	.....	.....
Total	4,486,070	88,390	672,980
Year to date	36,113,510	978,170	3,085,980

Shipped during week to separating plants, 1,583,500 lb. zinc ore.

Joplin, Mo., Mar. 9—The high price of zinc sulphide ore is $57.50, and the assay price per ton of 60% zinc is $50@55.50. Zinc silicate sold at $27@30 per ton of 40% zinc. The average price, all grades of zinc, is $49.96 per ton. Lead ore sold all week at $53@54.50 per ton, unchanged from last week. The average price, all grades of lead, is $53.70 per ton.

SHIPMENTS, WEEK ENDED MAR. 9

	Blende	Calamine	Lead Ore	Value
Webb City-Carterville	4,400,670	.....	1,047,400	$140,485
Joplin	1,825,810	.....	306,340	55,740
Alba-Neck	893,880	.....	55,070	25,620
Galena	808,970	.....	119,920	23,460
Carl Junction	524,330	.....	.....	14,680
Duenweg	451,380	.....	74,510	13,520
Oronogo	434,660	.....	71,720	11,978
Granby	278,780	356,330	19,210	11,630
Cave Springs	382,960	.....	.....	8,425
Miami	42,440	.....	233,850	7,200
Carthage	221,620	.....	.....	5,540
Spurgeon	73,950	115,200	71,120	5,350
Jackson	121,290	.....	15,710	3,330
Springfield	112,200	.....	.....	3,030
Lawton	118,150	.....	.....	2,950
Quapaw	109,330	.....	.....	2,620
Aurora	49,180	66,000	.....	2,100
Stott City	62,660	.....	.....	1,500
Totals	10,912,260	537,530	2,014,480	$339,158
10 weeks	96,210,270	5,401,900	15,461,110	$2,670,508

Blende val., the week, $277,168; 10 weeks, $2,167,324
Calamine, the week, 7,890; 10 weeks, 74,514
Lead value, the week, 54,100; 10 weeks, 428,670

MONTHLY AVERAGE PRICES

Month	Zinc Ore: Base Price		Zinc Ore: All Ores		Lead Ore: All Ores	
	1911	1912	1911	1912	1911	1912
January	$41.85	$44.90	$40.55	$43.54	$55.68	$58.92
February	40.21	45.75	39.16	43.31	54.46	52.39
March	39.85	.....	38.45	.....	54.57	.....
April	38.88	.....	37.47	.....	56.37	.....
May	38.25	.....	36.79	.....	55.21	.....
June	40.50	.....	38.18	.....	56.49	.....
July	40.75	.....	38.36	.....	58.81	.....
August	42.50	.....	41.28	.....	60.74	.....
September	42.63	.....	41.29	.....	59.33	.....
October	42.38	.....	40.89	.....	54.72	.....
November	45.40	.....	43.25	.....	57.19	.....
December	44.13	.....	40.76	.....	62.03	.....
Year	$41.45	.....	$39.90	.....	$56.76	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

New Caledonia Ores

Exports of ores from New Caledonia for the year ended Dec. 31, 1911, as reported by the *Bulletin du Commerce,* of Noumea, were 120,060 metric tons nickel ore, 32,807 tons chrome ore and 4 tons iron ore. Exports of metals were 301 tons nickel matte and 798 tons copper matte.

Chemicals

New York, Mar. 13—The general market remains quiet, with some signs of improvement.

Copper Sulphate—A fair trade is being done at last prices, $4.90 per 100 lb. for carload lots and $5.15 per 100 lb. for smaller parcels.

Nitrate of Soda—Business is improving, as the influence of the spring trade begins to be felt. Quotations are 2.22½c. per lb. for both spot and future positions.

Arsenic — Supplies are still rather scarce. Quotations remain at $2.75@3 per 100 lb. for white arsenic.

Imports and Exports—Imports and exports of chemicals and raw material in the United States, month of January:

	Imports	Exports		Excess
Copper sulph. lb.	.....	1,306,079	E.	1,306,079
Copper sul., '11	.....	1,137,105	E.	1,137,105
Bleach, lb.	9,414,490	.....	I.	9,414,490
Bleach, 1911	8,880,365	.....	I.	8,880,365
Potash salts, lb.	79,084,635	4,000	I.	79,080,835
Potash salts, '11	88,558,067	100,000	I.	88,458,067
Soda salts, lb.	1,040,146	58,205	I.	981,941
Soda salts, 1911	4,177,218	90,180	I.	4,087,038
Acetate lime, lb.	.....	4,161,248	E.	4,161,248
Acetate, 1911	.....	2,371,804	E.	2,371,804
Nit. of soda, tons	44,564	382	I.	44,182
Nitrate, 1911	61,351	857	I.	60,494
Phosphates, tons	.....	103,532	E.	103,532
Phosphates, '11	.....	61,375	E.	61,375
Sulphur, tons	2,082	1,902	I.	180
Sulphur, 1911	1,799	101	I.	1,698
Pyrites, tons	81,034	.....	I.	81,034
Pyrites, 1911	104,287	.....	I.	104,287
Magnesite, lb.	12,114,841	149,440	I.	11,965,401
Magnesite, 1911	26,245,673	.....	I.	26,245,673
Sul. ammonia, lb.	19,289,216	.....	I.	19,289,216
Sul. am'nia, '11	46,441,563	.....	I.	46,441,563
Arsenic, lb.	445,099	.....	I.	445,099
Arsenic, 1911	495,372	.....	I.	495,372

Exports include reëxports of foreign material. Estimating sulphur contents of pyrites the total quantity of sulphur imported this year was 43,797 tons.

Mining Stocks

New York, Mar. 13—On March 7 the Exchange was strong and rather active. Amalgamated Copper gained near 2 points and Steel common 1½. The Curb was irregular. Mining stocks were slow, while the Standard Oil issues were very strong.

March 8 there were some reactionary movements on the Exchange, but prices closed very near the opening level. On the Curb trading was wider, though the total sales were not heavy. Cobalts were firm and coppers irregular.

March 9 the Exchange was still firm, with some advance in Steel common. The Curb was fairly active and coppers were in good demand. Other mining stocks quiet, but firm.

March 11 there was a rather dull market on the Exchange and some weakness developed. Trading on the Curb was slow, with narrow fluctuations, the only large sales being of South Utah in the coppers, and of Tonopah Extension and Porcupine Northern in other mines. There was a sale of Homestake at $86.50 per share.

March 12 the Exchange was uncertain, with very small changes in price and light business. The Curb was irregular, with some demand for copper stocks at fractional declines; while Cobalt and Porcupine shares had fractional advances. On March 13 much the same conditions prevailed.

At auction in New York, March 7, sales were made of 20,000 shares Peregrina Mining & Milling Co. common, $10 par, at 10c. per share, and 45 shares preferred $100 par at $25 per share; 5000 shares Guanajuato Development Co. common, $100 par, 50c. per share, and $500 bonds at $200 for the lot; 1450 shares common, 400 shares preferred and $89,000 leasehold bonds of Herbert Collieries Co., $260 for the lot.

A special sale of the right, title and interest of the Development Co. of America in certain securities, for account of the Empire Trust Co., trustee, showed the following prices: 232,031 shares London-Arizona Copper Co., $10 par, $500 for the lot; 46,379 shares Lookout Copper Co., $10 par, $100 for the lot; $3000 Saddle Mountain Mining Co. bonds, $200 for the lot; Tombstone Consolidated Mines Co. $575,852 demand notes, $500, and $108,020 special contract bonds, $200; Imperial Copper Co. $25,200 special contract bonds, $200 for the lot, $238,000 demand notes, $200, and 664 shares, $10 par, $6 for the lot. Poland Mining Co. special contract bonds, $300, and 10,638 shares, $10 par, $7 for the lot; Development Co. of America, $144,000 gold bonds, $300 for the lot.

Boston, March 12—Dullness is the principal feature in the local mining-share list, although a fair amount of strength accompanies this condition.

Following the Wolverine's increased dividend rate the Old Dominion Co. has increased its rate of payment. In fact the latter company is declared to be earning at the rate of $5 per share, per annum. Of considerable interest is the publication of the annual reports of the Calumet & Hecla subsidiary companies. Accompanying them are recommendations by the management relative to new stamp mill arrangements, which involve several of these companies. Tamarack will benefit to the amount of $230,000 by the sale of a portion of its mill and the others will receive additional mill facilities and reduced costs.

The market for Amalgamated is closely watched as it is considered the key to the situation. An increase in this com-

COPPER PRODUCTION REPORTS.

Copper contents of blister copper, in pounds.

Company	Dec.	Jan.	Feb.
Alaska shipments.	4,995,008	3,701,010	.....
Anaconda	23,500,000	26,350,000	27,450,000
Arizona, Ltd.	3,100,000	3,200,000	3,020,000
Balaklala	.....	.....	.....
Copper Queen	8,365,265	6,748,264	6,046,864
Calumet & Ariz.	4,486,000	4,544,000	4,452,000
Detroit	1,969,313	1,941,970	2,008,374
East Butte	1,498,000	.....	.....
Mammoth	1,721,404	1,665,319	.....
Mason Valley	.....	600,000	.....
Miami	2,500,000	2,600,000	.....
Nevada Con.	4,679,674	6,309,228	.....
Old Dominion	2,610,000	2,044,000	2,039,000
Ray	2,660,000	2,476,945	.....
Shannon	1,255,858	1,550,000	1,300,000
South Utah	267,514	189,678	.....
United Verde*	2,000,000	.....	.....
Utah Copper Co.	9,039,557	8,156,612	.....
Lake Superior*	17,500,000	.....	.....
Non-rep. mines*	8,500,000	8,400,000	.....
Total production.	100,647,593	.....	.....
Imports, bars, etc.	21,101,256	31,790,590	.....
Total blister	121,748,849	.....	.....
Imp. in ore & matte	5,159,997	8,340,740	.....
Total	126,908,846	.....	.....
Brit. Col. Cos.:			
British Col. Copper	.....	.....	.....
Granby	.....	1,607,558	.....
Mexican Cos.:			
Boleo	2,645,640	2,315,040	.....
Cananea	3,706,000	3,552,000	.....
Moctezuma	2,864,464	2,732,867	2,687,712
Other Foreign:			
Cape Cop., S. Africa	701,120	784,000	.....
Kyshtim, Russia	1,570,000	.....	.....
Spassky, Russia	721,280	795,200	.....
Famatina, Argen.	217,280	172,480	.....
Tilt Cove, Newf'd.	.....	153,257	.....
Exports from:			
Chile	5,824,000	8,064,000	6,720,000
Australia	11,200,000	7,056,000	7,164,000
Arrivals in Europe from other count.†	16,331 840	13,144,320	10,868,680

Figures are reports received from companies, unless otherwise stated. Boleo copper does not come to American refiners.

*Estimated. †Does not include the United States, Australia or Chile.

STATISTICS OF COPPER.

Month	United States Product'n	Deliveries, Domestic	Deliveries for Export
II, 1911	109,828,297	50,518,998	45,111,019
III	130,532,080	66,080,789	59,081,127
IV	118,085,223	52,407,650	62,129,599
V	126,962,544	64,543,963	61,978,557
VI	124,554,312	61,655,561	71,460,519
VII	112,167,934	56,982,582	74,880,658
VIII	125,493,667	59,935,364	69,855,660
IX	115,588,950	57,311,584	50,824,011
X	118,255,442	64,068,307	60,084,349
XI	111,876,601	68,039,776	67,049,279
XII	122,896,697	65,988,474	79,238,716
Year, 1911	1,431,938,338	709,611,605	754,902,233
I, 1912	119,337,753	62,343,901	80,167,904
II	116,035,809	56,228,368	63,148,096

	Visible Stocks		
	United States	Europe	Total
III, 1911	156,637,770	233,385,600	390,023,009
IV	162,007,934	223,014,400	385,022,434
V	165,555,908	212,284,800	377,840,708
VI	165,995,932	202,540,800	368,536,732
VII	157,434,164	195,932,800	353,366,964
VIII	137,738,858	191,891,840	329,630,698
IX	133,441,501	191,228,800	324,670,301
X	140,894,856	191,945,600	332,840,456
XI	134,997,642	176,825,600	311,823,242
XII	111,785,188	164,281,600	276,066,788
I, 1912	89,454,695	158,323,200	247,777,895
II	66,280,643	154,851,200	221,131,843
III	62,939,988	141,142,400	204,082,388

Figures are in pounds of fine copper. U. S. production includes all copper refined in this country, both from domestic and imported material. Visible stocks are those reported on the first day of each month, as brought over from the preceding month. Stocks at Hamburg and Rotterdam are included in the visible stocks for Europe.

pany's dividend rate will go further toward promoting a good feeling and active times in copper shares than any other one thing.

Curb trading has been of fair volume and at firm prices.

Assessments

Company	Delinq	Sale	Amt
Algomah, Mich	Jan. 22		$1.00
Alpha Con., Nev	Feb. 21	Mar. 13	0.05
Best & Belcher, Nev	Mar. 19	Apr. 8	0.05
Black Jack, Utah	Feb. 6		0.01
Boston Ely, Nev	Jan. 18		0.50
Challenge, Nev	Mar. 5	Mar. 26	0.05
Crown Point, Nev	Mar. 28	Apr. 19	0.05
Crown Point, Utah	Feb. 15	Mar. 11	0.005
Exchequer, Nev	Feb. 14	Mar. 6	0.05
Hancock, Mich	Mar. 28		1.00
Kentuck, Nev	Feb. 29	Mar. 19	0.05
King David, Utah	Feb. 13	Mar. 6	0.005
Lehi Tintic, Utah	Feb. 29		0.01½
Lower Mammoth, Utah	Mar. 16		0.01
New York Bonanza, Utah	Mar. 14	Apr. 4	0.02
Ojibway, Mich	Jan. 10		1.005
Raven, Mont	Feb. 1		0.10
Savage, Nev	Feb. 14	Mar. 7	0.10
Sierra Nevada, Nev	Apr. 3	Apr. 24	0.10
Southwestern Miami, Ariz	Jan. 15		1.00
Spider, Utah	Jan. 15	Feb. 15	0.002
Swansea Con., Utah	Jan. 17	Feb. 8	0.01
Tintic Central, Utah	Mar. 9	Mar. 27	0.005
Tintic Standard, Utah	Jan. 8	Feb. 5	0.00
Union Con., Nev	Feb. 20	Mar. 12	0.15
Utah, Nev	Jan. 19	Feb. 9	0.05
Wabash, Utah	Mar. 19	Apr. 10	0.10
Yellow Jacket, Nev	Jan. 31	Mar. 6	0.10

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1910	1911	1912	1910	1911	1912
January	52.375	53.795	56.260	24.154	24.865	25.887
February	51.534	52.222	59.043	23.794	24.081	27.190
March	51.454	52.745		23.690	24.324	
April	53.221	53.325		24.483	24.595	
May	53.870	53.308		24.797	24.583	
June	53.462	53.043		24.651	24.486	
July	54.150	52.630		25.034	24.286	
August	52.912	52.171		24.428	24.082	
September	53.295	52.440		24.567	24.209	
October	55.490	53.340		25.596	24.594	
November	55.635	55.719		25.680	25.649	
December	54.428	54.965		25.160	25.349	
Year	53.486	53.304		24.670	24.592	

New York quotations, cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

	New York				London, Standard	
	Electrolytic		Lake			
	1911	1912	1911	1912	1911	1912
January	12.295	14.094	12.680	14.337	55.600	62.760
February	12.256	14.084	12.611	14.329	54.974	62.893
March	12.139		12.447		54.704	
April	12.019		12.275		54.034	
May	11.989		12.214		54.313	
June	12.385		12.611		56.365	
July	12.463		12.720		56.673	
August	12.405		12.634		56.266	
September	12.201		12.508		55.253	
October	12.189		12.370		55.170	
November	12.616		12.769		57.253	
December	13.552		13.768		62.068	
Year	12.376		12.634		55.973	

New York, cents per pound. London, pounds sterling per long ton of standard copper.

TIN AT NEW YORK

Month	1911	1912	Month	1911	1912
January	41.255	42.529	July	42.400	
February	41.614	42.962	August	43.319	
March	40.157		September	39.755	
April	42.185		October	41.185	
May	43.115		November	43.125	
June	44.606		December	44.655	
			Av. Year	42.281	

Prices are in cents per pound.

LEAD

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	4.483	4.435	4.334	4.327	13.009	15.619
February	4.440	4.026	4.266	3.946	13.043	15.738
March	4.394		4.238		13.122	
April	4.412		4.262		12.889	
May	4.373		4.223		12.984	
June	4.435		4.292		13.260	
July	4.499		4.397		13.530	
August	4.500		4.406		14.260	
September	4.485		4.356		14.744	
October	4.265		4.139		15.332	
November	4.298		4.181		15.821	
December	4.450		4.332		15.648	
Year	4.420		4.286		13.970	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month	New York		St. Louis		London	
	1911	1912	1911	1912	1911	1912
January	5.452	6.442	5.302	6.292	23.887	26.642
February	5.518	6.499	5.368	6.349	23.276	26.661
March	5.563		5.413		23.016	
April	5.399		5.249		23.743	
May	5.348		5.198		24.375	
June	5.520		5.370		24.612	
July	5.695		5.545		25.006	
August	5.953		5.803		26.801	
September	5.869		5.719		27.750	
October	6.102		5.951		27.256	
November	6.380		6.223		26.795	
December	6.301		6.151		26.849	
Year	5.758		5.608		25.281	

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

PIG IRON AT PITTSBURG

	Bessemer		Basic		No. 2 Foundry	
	1911	1912	1911	1912	1911	1912
January	$15.90	$15.12	$14.40	$13.32	$14.75	$14.00
February	15.90	15.03	14.50	13.28	14.81	14.01
March	15.90		14.65		14.96	
April	15.90		14.65		15.00	
May	15.90		14.30		14.72	
June	15.90		14.06		14.56	
July	15.90		14.03		14.53	
August	15.90		14.00		14.47	
September	15.90		13.57		14.40	
October	15.43		13.44		14.34	
November	14.92		13.30		14.25	
December	15.15		13.10		13.90	
Year	$15.72		$13.94		$14.49	

STOCK QUOTATIONS

COLO. SPRINGS Mar. 12

Name of Comp.	Bid.
Acacia	.06
Cripple Cr'k Con	.02
C. K. & N	.16⅜
Doctor Jack Pot	.05⅛
Elkton Con	.58
El Paso	.67½
Findlay	.04½
Gold Dollar	.14/16
Gold Sovereign	.02
Isabella	.11½
Jack Pot	.05
Jennie Sample	.04½
Lexington	.01
Moon Anchor	.01
Old Gold	.03½
Mary McKinney	.52
Pharmacist	.01⅞
Portland	.90
Vindicator	.70
Work	.007

SALT LAKE Mar. 12

Name of Comp.	Bid.
Beck Tunnel	.16½
Black Jack	.15
Carisa	‡.15
Cedar Talisman	.02½
Colorado Mining	.36
Columbus Con	.22
Daly-Judge	10.00
Grand Central	.75
Iron Blossom	1.25
Little Bell	.35
Lower Mammoth	.03½
Mason Valley	12.25
May Day	.15½
Nevada Hills	2.70
New York	‡.03
Prince Con	1.17½
Silver King Coal'n	1.57½
Sioux Con	.09
Uncle Sam	.26½
Yankee	‡.15

TORONTO Mar. 12

Name of Comp.	Bid	Name of Comp.	Bid
Coniagas	7.05	Pearl Lake	.17
Hudson Bay	‡70.00	Porcu. Gold	.45
Temiskaming	.37	Porcu. Tisdale	.02
Wettlaufer-Lor	.73	Preston E. D	.07½
Apex	.06	West Dome	.50
Central	‡3.75	Standard	.18½
Dobie	.60	Foley, O'Brien	.32
Dome Exten	.50	Rea	.80
Hollinger	10.90	Crown Chartered	.17
Imperial	.05	Swastika	.22

SAN FRANCISCO Mar. 12

Name of Comp.	Clg.	Name of Comp.	Bid
COMSTOCK STOCKS		MISC. NEV. & CAL.	
Alta	.05	Belmont	10.40
Belcher	.65	Jim Butler	.50
Best & Belcher	.11	MacNamara	.25
Caledonia	4.00	Midway	.31
Challenge Con	.25	Mont.-Tonopah	2.30
Chollar	.11	North Star	.30
Confidence	.95	West End Con	1.42½
Con. Virginia	.77	Atlanta	.21
Crown Point	.60	Booth	.11
Gould & Curry	.05	C.O.D. Con	.12
Hale & Norcross	.23	Comb. Frac	.17
Mexican	3.45	Jumbo Extension	.28
Occidental	.60	Pitts.-Silver Peak	1.37½
Ophir	1.42½	Silver Pick	.09
Overman	2.00	St. Ives	.30
Potosi	.07	Tramp Con	‡.01
Savage	.23	Argonaut	‡2.00
Sierra Nevada	.29	Bunker Hill	‡5.50
Union Con	1.15	Cent. Eureka	.30
Yellow Jacket	.73	So. Eureka	‡5.00

N. Y. EXCH. Mar. 12

Name of Comp.	Clg.
Amalgamated	70¾
Am. Agri. Chem	59¾
Am.Sm.&Ref.,com	75⅛
Am. Sm.& Ref., pf.	104⅛
Am. Sm. Sec., pf. B	85¼
Anaconda	39
Batopilas Min	1¼
BethlehemSteelpf	59
Chino	26
Federal M.& S., pf.	38
Goldfield Con	4¾
Great Nor., ore ctf.	38¾
Homestake	86
Miami Copper	24⅜
Nat'nalLead,com.	53⅛
National Lead, pf.	107
Nev. Consol	19¼
Pittsburg Coal, pf.	82
Ray Con	17⅛
RepublicI&S,com.	19⅜
Republic I & S, pf.	71⅜
SlossSheff'd,com.	41⅜
Sloss Sheffield, pf.	100
Tennessee Copper	37½
Utah Copper	56¾
U. S. Steel, com	64⅛
U. S. Steel, pf	110⅛
Va. Car. Chem	53½

N. Y. CURB Mar. 12

Name of Comp.	Clg.
Barnes King	‡.12
Beaver Con	.48
Braden Copper	5⅛
B. C. Copper	4⅜
Buffalo Mines	‡1¼
Butte & Vipond	‡.53
Butte Coalition	‡23
Caledonia	.74
Con. Ariz. Sm	9/16
Davis-Daly	1/16
Diam'field-Daisy	12
Ely Con	7/16
Florence	‡.60
Giroux	4⅜
Gold Hill Con	‡⅛
Greene Cananea	7⅝
Greenwater	.08
Guggen. Exp	200
Inspiration Con	18¾
Internat. S. & R	‡128
Kerr Lake	2 1/16
La Rose	3⅞
McKinley-Dar-Sa	1 1/16
Min. Co. of A. new	3½
Nev. Utah M. & S	7/16
Nipissing Mines	7¾
Ohio Copper	1⅞
Pacific Sm. & M	2/16
Porcupine T'nsite	‡.03½
Precious Metals	‡1⅜
Ray Central	2⅛
Red Warrior	‡1⅛
South Utah M. & S	11/16
Standard Oil (Old)	853
Stand'd Oil of N.J.	364
Stand'd Oil Subs	500
Stewart	1 3/16
Tonopah	7⅛
Tonopah Ex	2⅛
Tri-Bullion	11/16
Tularosa	2/16
United Cop., pfd.	15
Yukon Gold	3 7/16

LONDON Mar. 13

Name of Com.	Clg.
Camp Bird	£1 9s 6d
Dolores	1 10 0
El Oro	0 17 3
Esperanza	1 12 0
Mexico Mines	6 15 0
Oroville	0 6 3
Stratton'sInd.	0 2 1½
Tomboy	1 0 6

BOSTON EXCH. Mar. 12

Name of Comp.	Clg.
Adventure	7½
Algomah	5⅞
Allouez	39¾
Am. Zinc	26
Ariz. Com., ctfs	4⅝
Bonanza	40
Boston & Corbin	7⅝
Butte & Balak	4
Calumet & Ariz	61¾
Calumet & Hecla	450
Centennial	20
Con. Mercur	.06
Copper Range	55¾
Daly West	5¾
East Butte	13
Franklin	13½
Granby	36½
Hancock	32½
Hedley Gold	17
Helvetia	1 3/16
Indiana	14½
Island Cr'k, com	43½
Island Cr'k, pfd	87
Isle Royale	28
Keweenaw	1 3/16
Lake	37
La Salle	5½
Mass	7¾
Michigan	3
Mohawk	55
New Arcadian	4⅝
New Idria Quick	7⅛
North Butte	27¾
North Lake	6⅛
Ojibway	6¾
Old Dominion	48½
Osceola	114
Quincy	78
Shannon	12
Shattuck-Ariz	19
Superior	27½
Superior & Bost	3¼
Tamarack	29
Trinity	5¾
Tuolumne	3¾
U. S. Smelting	38
U. S. Smelt'g, pf	47⅞
Utah Apex	2⅞
Utah Con	16
Victoria	4½
Winona	6½
Wolverine	105
Wyandot	2¾

BOSTON CURB Mar. 12

Name of Comp.	Last
Ahmeek	262
Bingham Mines	3½
Boston Ely	1⅜
Boswyocolo	.08½
Butte Central	6½
Cactus	.17
Calaveras	1⅜
Chief Cons	1½
Corbin	2⅜
Cortez	1 3/16
Crown Reserve	3½
First Nat. Cop	2⅜
Majestic	.58
Mazatan	‡½
Moneta Porc	.15
Nevada-Douglas	3⅜
New Baltic	4½
Oneco	2⅜
Raven Copper	.39
Rhode Island Coal	.13
San Antonio	‡3½
S. W. Miami	5⅜
South Lake	6
Trethewey	.65
Union Mines	‡½
United Verde Ext.	.35
Vulture	‡5⅞

‡Last quotation.